

CONTRIBUTIONS TO THE KNOWLEDGE OF SOUTH AFRICAN
MARINE MOLLUSCA. PART IV. GASTROPODA: PROSOBRAN-
CHIATA: RHIPIDOGLOSSA, DOCOGLOSSA. TECTIBRANCHIATA.
POLYPLACOPHORA. SOLENOGASTRES. SCAPHOPODA*

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(With 30 figures in the text)

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Fam. **Cocculinidae**

Thiele, 1929, p. 92.

Three dead shells, maj. diam. 2·25–2·3 mm., are most probably a species of *Cocculina*. The surface shows no distinctive sculpture, and in any case the absence of the animal would render the identification uncertain.

34° 27' S., 25° 42' E., 256 fathoms, 3 dead (S. Afr. Mus. A9344, P.F. coll.).

Fam. **Neritidae**

Baker, 1923, pp. 117–178, pls. 9–16 (radulae); Thiele, 1929, p. 71; Connolly, 1939, pp. 596–603 and 635 (S. Afr. terrestrial, fluviatile and estuarine genera: *Hydrocena*, *Neritina*, *Septaria*).

Gen. **NERITA** Linn.

Because the protoconch is not sunken (in the Neritid material available in S. Afr. Museum), I have suggested that *Nerita dubia* Turton 1932 (renamed *tomlini* Turton 1933) is the protoconch of a Calyptraeid: see Part 3, p. 73.

Living examples of the following species, not dealt with below, have been collected by U.C.T.:

plicata Linn. Durban.

polita Linn. Port Edward.

plexa Chemn. (*textilis* Gmelin; *exuvia* Lam., non Linn.). Port St. Johns.

* Part I. Toxoglossa: *Ann. S. Afr. Mus.* **44** (4), 1958.

Part II. Rhachiglossa: *Ann. S. Afr. Mus.* **45** (1), 1959.

Part III. Taenioglossa: *Ann. S. Afr. Mus.* **47** (1), 1963.

N. plexa and *plicata* extend as far as Port Elizabeth, according to information supplied by R. N. Kilburn.

N. undata Linn. comes as far south as Delagoa Bay (U.W.).

Braga (1952) gave photographic figures of *plexa*, *polita*, and *plicata*, in addition to *albicilla*.

Nerita albicilla Linn.

Fig. 1 a

Nerita albicilla Krauss, 1848, p. 89, and var. *fasciata*, p. 90; Cooke, 1895, fig. 130 (radula); Turton, 1932, p. 201, and vars. pl. 52, no. 1401; Nardini, 1934, p. 239, pl. 18 (5), figs. 5, 6; Adam & Leloup, 1938, p. 48, pl. 4, fig. 1, text-fig. 14 (radula); Braga, 1952, p. 91, pl. 6, figs. 1, 2.

Radula with *c.* 100 plus nascent rows, cutting-edge of capitelliform plate obscurely serrulate (on unworn plates), marginal plates very numerous (Baker, loc. cit., stated 78), inner plates hamate, outer ones ligulate, with minutely denticulate truncate apices.

Fossil: Pleistocene; Red Sea, Kenya (Newton, Cox, Nardini).

Living: Mozambique Island and Delagoa Bay (S. Afr. Mus. coll. K. H. B.; also U.W.); Inhambane (U.C.T.); Natal (Krauss); Durban (U.C.T.); Knysna, 1.viii.1898 (S. Afr. Mus. P.F. coll.); Natal to Algoa Bay and Cape Recife (Kennelly).

Dead: Still Bay (S. Afr. Mus. coll. Muir); Jeffreys Bay (Kennelly).

Distribution. Mauritius, Madagascar, Seychelles, and widely distributed in Indo-Pacific.

Remarks. The Pieter Faure found a large specimen: alt. 24, diam. 33 mm., at low tide $\frac{1}{4}$ – $\frac{1}{2}$ mile above the jetty at Knysna on 1 August, 1898.

The Muir material consists of juveniles of diam. 1 to 6.5 mm. The smallest has a protoconch of about $1\frac{1}{4}$ whorls and one postnatal whorl, but the junction is not clear. No spiral striae are visible on the protoconch, or on the 1st postnatal whorl, but growth-lines are distinct on the latter. Though most specimens are water-worn, the condition of this 1-mm. juvenile and some of the other shells is fresh enough to suggest that the species may be living in this locality.

Nerita umlaasiana Krss.

Nerita umlaasiana Krauss, 1848, p. 89, pl. 5, fig. 25; von Martens, 1879, p. 734; Baker, 1923, p. 165 ('specific distinction doubtful'); Janus, 1961, p. 4, pl. 2, figs. 4–6.

This seems to be a valid species, distinguished (as Krauss stated) from *polita* by its shape, the spirally lirate early whorls, and the granulate operculum. The operculum is not unlike that of *albicilla*, but the columellar glaze of the latter is nodulose. The operculum of *polita* is smooth, with a transversely ribbed band on outer margin.

The colour varies from black to olivaceous grey, variously marbled and speckled, often with axial zigzags, and with 3 more or less conspicuous darker spiral bands.

Radula as in *albicilla*.

Durban and Scottburgh (S. Afr. Mus. coll. Burnup); Umhlali (Natal) (U.C.T.).

Lectotype in Stuttgart Museum (Janus, 1961).

The locality 'Knysna' is surely a *laps. cal.* on the part of Krauss. It occurs after the Latin diagnosis, but after the German description and contrast with *polita*, the locality Umlaas is given, in conformity with the specific name. (See also: von Martens, 1888, p. 83.)

Von Martens recorded it from Quelimane, and regarded it as a subspecies of *polita* with stronger spiral grooves over the *whole shell*; but apparently he saw no specimen with an operculum.

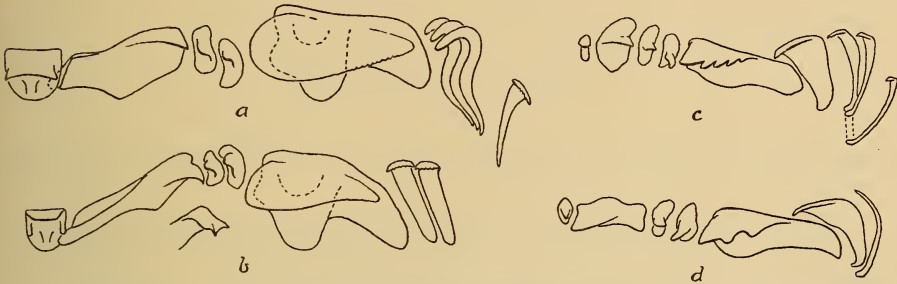


FIG. 1. Radula plates of: a, *Nerita albicilla* Linn. b, *Neritina natalensis* Rve. c, *Smaragdina sowerbiana* (Montr.). d, *S. rangiana* Récluz.

Neritina natalensis Rve.

Fig. 1 b

Neritina natalensis Rve., Connolly, 1939, p. 599.

Radula with *c.* 125 plus nascent rows, 1st lateral plate transversely elongate, oblique to axis, 4th lateral (capitelliform) with obscurely serrulate cutting-edge, marginal plates very numerous (Baker, loc. cit., stated 73-75 for *gagates*), narrow, linguliform, with reverted denticulate apices.

In addition to the localities mentioned by Connolly: Port St. Johns, Port Shepstone, and Limpopo at Vila Joao Belo (U.C.T.).

The egg-capsules of *Neritina* are calcareous, and possibly capable of surviving immersion in sea-water, thereby furthering dispersal (by floating logs) across the sea.

Septaria porcellana (Linn.)

Navicella porcellana Sowerby, 1850, p. 547, pl. 117, figs. 1, 2; pl. 118 bis, figs. 43, 44.

Navicella elliptica Lam., von Martens, 1879, p. 735.

Widenham (Natal), 1 shell, animal extracted, operculum not preserved, 32 × 27 mm. (S. Afr. Mus. coll. J. A. Swan).

Distribution. Bourbon; Mauritius; Madagascar; Anjoan, Comoro Islands (von Martens).

Remarks. Connolly (1939, p. 601) recorded *tessellaria* (Lam.), and remarked

that more than one species might occur in Natal. Specimens of *porcellana* were not received at the South African Museum until 1941.

For purposes of record the following may be quoted from Mr. Swan's letter of 28 July 1941 (to McGregor Museum, Kimberley): '... Seventy years ago a hot spring supplied the streamlet with warm water. . . . An eruption which was far out at sea [*sic*] and strewed Widenham beach with pumice stone, stopped the hot spring. I do not think there are many more big limpets [*sic*] left. . . . The stream is difficult to get at and the interesting bit is particularly difficult. It is *Bilharzia* infected. . . . It would appear—after many days of search—that only one pool of limited size contains the big limpet.'

Gen. SMARAGDIA Issel

Baker, 1923, pp. 135, 172 (with subgen. *Smaragdella*); Thiele, 1929, p. 76.

Smaragdia rangiana Récluz

Fig. 1 d

Neritina rangiana von Martens, 1880, p. 292; Odhner, 1919, p. 33; Dautzenberg, 1929, p. 527.
Smaragdia rangiana Thiele, 1929, p. 77, fig. 52 (radula).

Radula with *c.* 125 rows, 1st lateral plate transversely oblong, 4th lateral (capitelliform) with 2 blunt cusps outside the main cusp, 1st marginal plate triangular, apical truncate margin wider than in *souverbiana*, smooth, following marginals 12 in number, slender, tapering.

Living: Delagoa Bay (U.W.).

Distribution. Mauritius, Madagascar (von Martens, Odhner, Dautzenberg); Providence Reef, Mascarenes (Smith, 1884).

Smaragdia souverbiana (Montrouzier)

Fig. 1 c

Neritina souverbiana Smith, 1910, p. 204; Turton, 1932, p. 202, pl. 53, no. 1403.
Smaragdia souverbiana Connolly, 1939, p. 599.

Radula with *c.* 65 rows, 1st lateral plate ovoid, 4th lateral (capitelliform) with 4 cusps outside the main cusp, 1st marginal plate broadly triangular, truncate apex reverted, smooth, following marginals successively narrower, reverted apical margin minutely denticulate, the bases of the 12 marginals form a longitudinal row on outer edge of the radula (as noted by Baker, loc. cit., p. 173, who stated there were 22 marginals).

Living: Congella (Durban Bay) (Smith, Connolly; also S. Afr. Mus. coll. Burnup); Richards Bay (U.C.T.); Delagoa Bay (U.W.).

Dead: Port Alfred (Turton).

Distribution. Madagascar (Dautzenberg).

Fam. **Phenacolepadidae**

Pilsbry, 1900, p. 61 (list of species); Thiele, 1929, p. 78.

Phenacolepas asperulata (H. & A. Adams)

Fig. 2 a, b

Scutellina asperulata H. & A. Adams, 1854, p. 461.*Phenacolepas asperulata* Thiele, 1909a, p. 32, pl. 5, fig. 9; Dautzenberg, 1929, p. 548; Satyamurti, 1952, p. 64, pl. 4, figs. 2 a-d.

Vertical from apex falling 1.5 mm. within hind margin (length of shell 12 mm.), apex 3 mm. above base line. Radiating lirae *c.* 90, including intermediaries, of which one occurs between most of the pairs of main lirae, but not reaching apex; all lirae studded with acute, upstanding squamae, *c.* 40-44 on the anterior main lirae. Pink. 12 × 10, alt. 4 mm.

Radula with 65-75 rows, central plate squarish, rounded in front, margin slightly overturned but not serrate, 1st lateral plate about twice as wide as long, oblique, distal margin with serrate cutting-edge, 2nd lateral small, subcircular, with narrow front edge, 3rd lateral ovate, with oblique thickening forming a cutting-edge, 4th lateral large, subtriangular, front margin overturned forming a cutting-edge but not serrate, marginal plates numerous, finely and sharply serrate.

Inhaca Island, Delagoa Bay, under stones (U.W.).

Distribution. India; Madagascar.

Remarks. I assign these shells tentatively to *asperulata* because they agree well with Satyamurti's description and figure. According to Schepman (1908, p. 15), Smith considered this species a synonym of *galathea* (Lam.) (cf. fig. 2815 in Chenu, 1859).

Phenacolepas cf. fulva (Müller)

Fig. 2 c

Scutellina (Iothia) fulva Müll., H. & A. Adams, 1854, p. 461, pl. 52, fig. 6c.*Iothia fulva* Müll., Chenu, 1859, fig. 2816.

Apex vertically above hind margin, apex 1.75 mm. above base line. Radiating lirae *c.* 112, including intermediaries, which do not reach apex; lirae studded with squamose granules, at least 80 on the anterior main lirae. Horny brown. 10 × 7.3, alt. 4 mm.

Radula with at least 100 rows, central plate squarish, front margin slightly overturned, not serrulate, 1st lateral plate about 2½ times as wide as long, oblique, whole front margin serrate (*c.* 12 cusps), 2nd lateral small, 3rd lateral with oblique cutting-edge, 4th lateral large, subtriangular, front margin overturned, not serrate, marginal plates very numerous, serrate.

Inhambane, on stony beach at Mongue (U.C.T.).

Remarks. In general shape narrower than *asperulata*; agreeing with both Adams's and Chenu's figures except that the apex is vertically above the hind margin.

Fam. **Phasianellidae**

Watson (1886, p. 124) considered that 'the characteristic features relied on for specific distinction are often quite untrustworthy in this most variable genus [*Phasianella*] and I know no marks by which many of the species can be determined'.

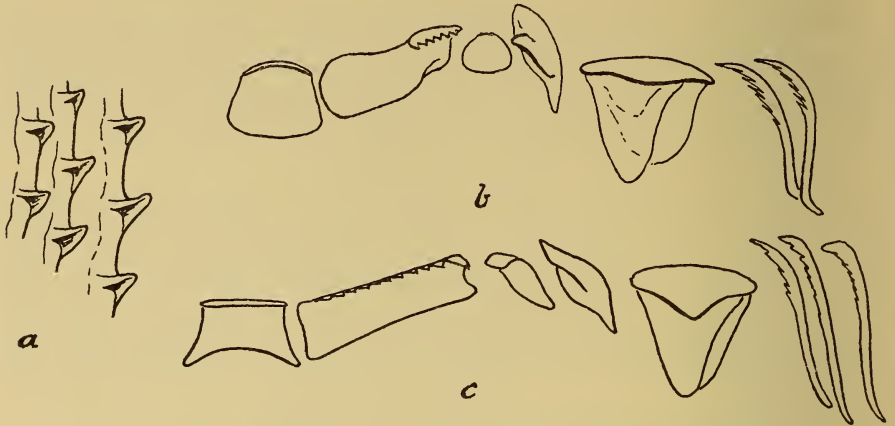


FIG. 2. *a, b*, *Phenacolepas asperulata* (H. & A. Adams), squamose lirae and radula plates. *c*, *P. cf. fulva* (Müller) radula plates.

Although extremely common on many beaches around the South African coast, no species of 'Phasianella' seems to have been recorded from any of the late Tertiary or Quaternary deposits. Dr. A. R. H. Martin in his very careful and exhaustive collecting at Sedgefield near Knysna did not obtain a single specimen.

Phasianella jaspidea Rve.Fig. 3 *a*

Phasianella jaspidea Reeve, 1862, pl. 4. sp. xi; von Martens, 1879, p. 735.

Radula with 30 rows, central plate reduced to a mere strip, not always visible, 5 lateral plates each with a strong cusp, those of the 4th and 5th plates smaller, marginal plates very numerous, the inner ones strongly hamate, apparently without subsidiary cusps, decreasing in size outwards, the outer ones very slender.

Inhambane (U.C.T.); Mozambique Island (S. Afr. Mus. coll. K. H. B.). Quelimane (von Martens). Not obtained at Delagoa Bay by U. W.

Gen. TRICOLIA Risso

Distinguished from *Phasianella* by the broad central plate of the radula.

When a species is abundant, with numerous variations in size, shape, and colour, sooner or later several nominal 'species' will be described, and especially

when the material is beach-worn. *T. kraussi* (Smith), *africana* (Bartsch), and Turton's 'species' were all described from beach material.

Krauss was cautious and remarked (1848, p. 105) that it could not be denied that all these four species [*capensis*, *kochii*, *elongata*, *tenuis*] were very closely allied, and that the differences as stated were not very great. When, however, the respective shells were laid side by side, he believed that specific separation was not unnecessary.

Turton's list of 18 species and 4 varieties, including 10 new species and the 4 varieties (some of which were based on single specimens) is quite unacceptable.

Vague characters such as the greater or lesser convexity of the whorls, more oval or less circular aperture, are valueless.

There are both broad and slender individuals, e.g. in a large quantity from one locality (Still Bay, coll. Muir) there are the following pairs: 3.5×3 and 3.5×2 mm. (breadth : length ratio 85–86% and 57%); 6×5.5 and 6×4 mm. (91% and 66%); 14×10 and 14×8.5 mm. (70% and 53½%); 15×10 and 15×9 mm. (66% and 60%). Cf. Turton's figures 1226 (*carinata*), 1228 (*fuscocomaculata*) and 1233 (*rufanensis* var. *adjacens*), all with a length of 6.5 mm.

The width ranges from 91% to 53½% of the length. Krauss's measurements for 4 species show a range from 88% to 48%: *kochii* 88%, *capensis* 63%, *elongata* 56%, *tenuis* 48%. In *africana* the width is 77%, and in *kraussi* 70% of the length.

Among the Still Bay series there are juveniles up to 2.2×2 mm. (90%) (2 whorls), but no slender shells of this length. The smallest juveniles (with one or 1½ postnatal whorls) measure 0.75×0.75 mm. See also Turton's figures 1218 and 1229.

A greater increase in length relatively to the width seems to take place after the 2nd whorl. A strong increase in length produces forms like *elongata* or *tenuis*, but a smaller increase results in the squat form *kochii*. Krauss noted that in *elongata* it is the last whorl which shows the greatest proportional lengthening, and consequently a more oval aperture.

Size seems to have attracted undue attention. Even Krauss stated that *kochii* was twice as large as *capensis*; *kraussi* (Smith), 5–6 mm. with 3½ whorls (but worn), was stated to be smaller than *capensis*; *africana* (Bartsch), 3.5 mm. with 3½ whorls, was distinguished from *capensis* by its 'minute size'. There must be juveniles, but no comparison of equal-sized examples of the so-called 'species' seems to have been made.

Colour and pattern are no criteria for discriminating species. Krauss noted the contrast of the dull matt colour, with indistinct markings, of fresh shells, and the brightly coloured and variously patterned beach-worn shells. Bright pink or red is to some extent due to the chemical action of weathering. On the other hand in some fresh shells the colour and pattern show clearly when wet, but fade away when dried.

Bartsch mentioned the presence of a series of light blue spots in *africana*, and Turton regarded this as a distinguishing mark, though occurring also in

Turton's 'bicarinata'. These blue or emerald-green spots are frequently found not only in the narrower forms (*capensis* and *africana*), but also in the broad form *kochii*.

One colour variety which Turton named *kochii* var. *viridis* (1932, renamed *rietensis* 1933) is notable. Turton gave its colour as bright green, often with a white line near base, but no markings. Similarly coloured shells occur also at Still Bay, but are more yellowish olive-green or gamboge. Some have only the white basal line, others show the same mottling, axial streaks, and emerald-green spots which are found on shells with a reddish ground colour. Frequently the yellow colour is tinged with red, or the early whorls are red, the later ones yellowish. One shell has the early whorls and the body whorl red, the penultimate whorl yellowish.



FIG. 3. Radula plates of: a, *Phasianella jaspidea* Rve. b, *Tricolia neritina* (Dnkr.).

Black shells from Port Alfred have been named *kochii* var. *nigra* and *farquhari* (the latter based on a single specimen) by Turton. U.C.T. has collected black shells at Port Nolloth, Lambert's Bay, Saldanha Bay, and at Kommetjie on the west coast of the Cape Peninsula. All the shells in the samples from these west coast localities, as submitted to me, were black; but perhaps they were specially picked out on account of their colour. Confirmatory evidence would be welcome as to whether animals with black shells live in a localized habitat or whether they occur promiscuously among the colourful shells.

I have seen one very dark blackish-maroon shell from Still Bay among many others of various colours and patterns; but both Turton and Dr. Muir collected only dead shells.

In view of the great variability in size, shape, and colour pattern, it is not unreasonable to suspect that there is only one species occurring along the South African coast. If so, what name should it bear? Philippi's *tenuis* (1844) seems to have priority over *capensis* Dunker 1846, which has precedence over *kochii* (Philippi in litt., Krss.) and *elongata* Krss. 1848.

Or are they all forms of the Mediterranean *pulla* (Linn.), which occurs on the west coast of Africa as far south as Senegal? Thiele (1925, p. 57) records *elongata* from Great Fish Bay, Angola.

In examining the present material one feature has been noted which was not mentioned by Krauss, Smith, or Bartsch, but which was used by Turton to characterize his *striolata*, *piperata*, and *insignis* (figs. 1237, 1238, 1239). Both of Krauss's figures 4 show faint spiral lines on the upper part of the body whorl,

but probably these were intended to represent *colour* lines, not sculpture. Turton said that *kochii* when young had 'spiral lines', also presumably meaning colour lines, because he separated those forms with 'spiral cords' as distinct species.

If the shell is not too much worn the whorls are finely spirally lirated (*insignis*), though as a rule the lirae are closer together and more numerous than appears in Turton's fig. 1239. On the other hand, in Turton's other two species there are only 5 or 6 rather widely spaced lirae. Examples of the latter are not common, and are usually broad; but shells with numerous lirae may be either the broad form or the slender form.

Shells in which the lirae are well developed and one of them is enlarged to form a shoulder (a cingulum or carina) have been named *tropidophora* Tomlin 1931a. Cf. also Thiele's 5 mm. long *Turbo* sp. (1925, p. 56, pl. 14 (2), figs. 5, 6).

The spiral lirae may frequently remain visible on the base after they have been abraded from the whorls.

Unworn shells may also show very distinct growth-lines, in some cases so conspicuous as to be almost pliculae (cf. Turton's *farquhari*, fig. 1234).

Until a thorough study has been made of living material, a diagnosis is not possible; but the following characters may be given.

Protoconch consisting of nucleus and little more than one whorl, smooth. Postnatal whorls 4-4½. Juveniles with protoconch and one or 1½ whorls measure 0.75 × 0.75 mm. Spiral sculpture (when present) not showing on 1st whorl, but distinct on 2nd and later whorls (variation: see above). Growth-lines often conspicuous. Aperture more or less oval according to the length of the last whorl.

Largest specimen seen: 16 × 10 mm. Width ranging from 91 per cent to 53½ per cent of length.

Radula with *c.* 50 rows (45-55), as in *neritina* (*infra*).

From Umpangazi (Zululand) around the coast to Port Nolloth.

Remarks. *T. elongata* (Krss.) is recorded from Madagascar by Dautzenberg (1929, p. 528), and also *T. zigzag* (Odhner) (1919, p. 31, pl. 2, fig. 25); the latter has a colour pattern frequently found in South African examples, but no specific diagnostic characters were given.

Turton's *Leptothyra subconica* (1932, p. 178, pl. 42, no. 1257) may be a *Tricolia*.

Tricolia tropidophora (Tomlin)

? *Phasianella bicarinata* (non Dunker) Bartsch, 1915, p. 145; Turton, 1932, p. 174.

Phasianella tropidophora Tomlin, 1931a, p. 420, pl. 33, fig. 1.

Phasianella insignis Turton, 1932, p. 175, no. 1239.

Protoconch 1½ whorls. First postnatal whorl with 4 spiral lirae, 2nd with 7, the 4th forming a slight angular shoulder approximately in middle of whorl, 3rd whorl with 8-11 lirae, the 5th forming a more distinct shoulder. Sometimes 5 lirae on the upper half of the whorl, the 6th then forming the shoulder.

The shoulder lira may be scarcely stronger than the other lirae, or may form a distinct cingulum or carina, below which the profile of the whorl is slightly flattened. Base with 9–12 spiral lirae, the uppermost one (emerging from top of aperture) slightly stronger than the others, and though scarcely cariniform, is strong enough to affect the profile (see Tomlin's figure). 5×3.75 mm.

Colour (when fresh and wet) pinkish, with numerous green spots on body whorl, which may coalesce into axial, or more often protractively oblique, stripes; penultimate whorl usually with pale spots or streaks, but green spots may also occur; base paler pink with pale or faintly greenish streaks. When dry, ground-colour and spots dull. Beach-worn specimens dull pinkish, with faint indications of spots.

Radula as in *neritina*.

East London, and Cape Peninsula (Tomlin). Several specimens from an unknown locality, identified by Tomlin (S. Afr. Mus.). Living: Knysna, Port Nolloth, Groen Rivier, Lamberts Bay, East London (U.C.T.).

Remarks. Although the shoulder lira and the basal lira and the flattening of the profile vary, these specimens can all be referred to *tropidophora*. Future study will decide whether *tropidophora* can remain a distinct species.

Turton's mention of the green spots and the 'not at all prominent' keels indicates that his 'bicarinata' was really this form and not the true *bicarinata*.

Tricolia bicarinata (Dnkr.)

Phasianella bicarinata, Dunker, 1846, p. 110; Krauss, 1848, p. 105.

Description of Kosi Bay specimen. Protoconch $1\frac{1}{2}$ whorls, forming a pointed apex, smooth. Postnatal whorls 4, the uppermost one noticeably wider than the protoconch; 2nd whorl with inconspicuous spiral keel a little below middle of whorl, 6 fine spiral lirae above, 2 below; 3rd whorl with a better-developed keel, *c.* 10 lirae above, 4 below; 4th whorl with well-marked keel, *c.* 12 lirae above, 4 below, followed by a second keel which becomes visible shortly prior to the aperture and is continued around the body-whorl (obscured by the suture on preceding whorls). Base below 2nd keel with *c.* 14 lirae, of which the 4th, 9th and 13th are stronger than the others, those below the 9th and 13th very fine. 4.5×3 mm.

Cape (Dunker, Krauss). Kosi Bay (Zululand) (U.C.T.).

Remarks. Distinguished by the rather prominent pointed apex, and the two strong keels.

I have seen a copy of Tryon's figure which shows, in comparison with the present specimen, only 3 whorls after the papilliform apex, all the whorls drawn too high, and the two keels too far apart.

Tricolia (Chromotis) neritina (Dnkr.)

Fig. 3 b

Phasianella neritina Dunker, 1846, p. 110; Krauss, 1848, p. 105, pl. 6, fig. 6.

Protoconch consisting of nucleus and very little more than 1 whorl, diam. 0.2 mm., smooth, white, thereby sharply demarcated from the pinkish 1st postnatal whorl. Up to diam. maj. 5 mm.

Numerous purplish obliquely spiral lines on a dull pinkish-brown ground-colour, often a few white spots around top of last whorl, sometimes also 2-3 on periphery. Bleached shells pink. One from Hondeklip Bay (U.C.T.) pure white with blackish apex.

Radula with *c.* 50-55 rows, central plate broad, oblong-oval, with 2 longitudinal ribs ending posteriorly in short points, 5 lateral plates, the 3 inner ones with triangular bases and sharply cuspidate cutting-edge, the 2 outer ones smaller with longitudinally oblong bases and reduced cusps, marginal plates very numerous, the first 2 with bicuspid apex, the following ones with simple, obliquely truncate apices.

Cape (Krauss); Cape Town (Bartsch). Table Bay, False Bay, Still Bay (S. Afr. Mus.). East London (von Martens). Not found at Port Alfred (Turton).

Living: Lüderitzbucht and Hondeklip Bay to Table Bay, and False Bay to Port Elizabeth (U.C.T.).

Distribution. Mauritius (von Martens, 1880). A remarkable discontinuous distribution, if the provenance and identification of von Martens's shells were correct.

Fam. **Turbinidae**

Thiele, 1929, p. 64 (incl. *Phasianellinae* and *Liotiinae*).

Gen. **TURBO** Linn.

The following well-known species occur on the south and east coasts of South Africa:

<i>argyrostomus</i> Linn.	Delagoa Bay (U.W.).
<i>chrysostomus</i> Linn.	Durban (Smith, 1903).
<i>cidaris</i> Gmelin	<i>Vide infra.</i>
<i>coronatus</i> Gmelin	Off Cape Morgan, 36 fathoms (S. Afr. Mus. P.F. coll.); Durban (U.C.T.); Port St. Johns (S. Afr. Mus. F. H. Talbot coll.); Delagoa Bay (U.W.); Inhambane (U.C.T.); Bazarute Island (U.W.); Mozambique Island (S. Afr. Mus. coll. K. H. B.; also U.W.).
<i>natalensis</i> Krss.	<i>Vide infra.</i>
<i>petholatus</i> Linn.	Delagoa Bay (U.W.). Also <i>vide infra.</i>
<i>sarmaticus</i> Linn.	<i>Vide infra.</i>
<i>splendidulus</i> Sow.	Umzinto and Durban (Smith, 1903).

Smith's records of *chrysostomus* and *splendidulus*, collected by Burnup, may be acceptable, but confirmation would be welcome.

Sowerby (1897) recorded *intercostalis* Menke from Durban, but I am not aware that the record has been confirmed, or that the species is actually living on the South African coast. Schepman (1908, p. 24) said the identification of this species was difficult. For the present it had better not be admitted to the fauna list.

Thiele's 5 mm. long *Turbo* sp. (1925, p. 56, pl. 14 (2), figs. 5, 6) from 34° 51' S., 19° 37' E., 80 metres, seems more like a *Tricolia* than a *Turbo*. Cf. Turton's figures nos. 1237, 1238, 1239 on pl. 41 (1932).

Braga (1952, p. 92) recorded *marmoratus* Linn. from Mozambique Island.

No species has been found living west of Cape Point, or in Table Bay, or at any locality on the west coast of South Africa. Nicklès (1950, p. 45) stated that *cidaris* occurs from Mossamedes to South Africa, but the most southerly locality is Port Alexander (Odhner).

The radulae of the three species: *cidaris*, *natalensis*, and *sarmaticus*, agree in having a narrow central plate, whereas *coronatus* (subgen. *Lunella*) has a broad central plate (fig. 5 a).

The foot of *sarmaticus* and of *cidaris* is divided longitudinally by a groove, which gives the animal a swaying motion when it crawls (cf. Gilchrist, 1916, p. 43).

Turbo cidaris Gmelin

Figs. 4 a, b, c, d, 5 b

Liottia fulgens Gould, 1859, p. 142.

Ilaira fulgens Bartsch, 1915, p. 166, pl. 29, figs. 4-6; Turton, 1932, p. 195; Barnard, 1951, p. 113 (= juv.).

Turbo tricarimulatus and var. *bicarimulatus* Euthyme, 1885, pp. 252, 254.

Turbo cidaris Gmelin Schwarz, 1910, p. 115; Odner, 1923, p. 9; Thiele, 1925, p. 57; Houghton, 1932, p. 43.

Junction of protoconch and 1st postnatal whorl not distinct. Smallest example seen: alt. 0.2, diam. 0.5 mm., consisting of nucleus and one whorl. Flat, discoidal, periphery with 3 keels, the middle one a little more prominent than the others, visible in apical view. At alt. 0.9, diam. 2 mm., 2 whorls, the middle lira scarcely more prominent than the upper lira, and the lower lira has shifted towards the axis to form the basal lira surrounding the umbilicus. The apical surface is almost flat, with a shallow but distinct submarginal groove. At alt. 1.3, diam. 3 mm., 2 $\frac{3}{4}$ -3 whorls, the apical surface is gently convex, and the submarginal groove becomes merely a shallow concavity seen in the profile. On later whorls as the marginal keel disappears the concavity also disappears, and the profile becomes evenly convex.

At diam. 6.5, the alt. has increased to 5 mm. The periphery has 2 lirae (originally the upper and middle lirae) but the 3rd (originally the lower) has become weaker and closer to the umbilicus. At diam. 8 mm. the umbilicus is still open though the columellar callus is encroaching on it; and at diam. 10 mm. it is completely closed (contrast *sarmaticus*). A little hollow or dent, however, remains in the callus ('false umbilicus') and is characteristic.

Up to alt. 52, diam. 58 mm. Although *cidaris* does not increase so rapidly in altitude compared with diameter as does *sarmaticus*, eventually it becomes proportionately a slightly higher shell.

Operculum with a subcentral open umbilicus surrounded by a spiral ridge, both these features being retained in large examples, though I have seen one 21 mm. diam. in which the ridge is not sharp and well defined. The surface is covered, but not closely, with small *conical* granules or tubercles (contrast *sarmaticus*).

Many variations occur in ground-colour and pattern; some shells are uniform umber-brown. Except in the latter, two bands differing in colour from the ground-colour, and often spotted, indicate the position of the obsolete peripheral lirae.

The iridescence of the very early whorls, which seems to have been partly responsible for the institution of *fulgens*, is often retained in shells up to 10 mm. diam.

Fossil: Pleistocene; Port Elizabeth (Schwarz); Alexander Bay and Grauwe Duinen (Little Namaqualand) (Haughton).

False Bay eastwards to Port Alfred.

Distribution. Port Alexander, Angola.

Variation. The 2 peripheral lirae remain distinct up to about 15 mm. diam., or sometimes even up to 25 mm., but usually at the latter size they have disappeared as surface ridges. The normal smooth surface, however, sometimes shows more or less distinctly low rounded ridges: 3-4 between the suture and the upper peripheral lira, one between the 2 lirae, and 2-3 feebler ones on the base below the lower lira. When faint there is no hesitation in identifying the shell with *cidaris*, but when well developed there is a strong resemblance to *natalensis*. Such specimens seem to have induced Sowerby to regard *tricarinulatus* Euthyme as a 'small form of *cidaris* with the keels of *natalensis*', and the latter definitely as a variety of *cidaris*. Evidently he saw only shells without opercula, because the operculum of *natalensis* resembles that of *sarmaticus* (as Krauss stated) and is quite distinct from that of *cidaris*.

Euthyme made no mention of the subsidiary lirae which develop in *natalensis*, but laid stress on the 'false umbilicus' which is found in both *cidaris* and *natalensis* (but not in *sarmaticus*).

Turbo natalensis Krss.*

Turbo natalensis Krauss, 1848, p. 101, pl. 6, fig. 1.

Turbo ponsonbyi Sowerby, 1897, p. 17, pl. 6, fig. 20.

* Mr. S. P. Dance (British Museum) has informed me that the part of Reeve's *Conch. Icon.* containing the description of *natalensis* was published in January 1848. The *Preface* to Krauss is dated January 1848. Krauss (1852, p. 34) stated that Reeve published the name in *Ann. Mag.* March 1849, p. 227, the description having been communicated to a meeting of the Zoological Society on 28 March 1848. Krauss claimed priority 'weil ich sie schon im Januar 1848 in meiner Schrift bekannt gemacht habe'.

In this uncertainty as to the priority, I credit the authorship to Krauss on account of the excellence of his figure.

Smallest shell seen diam. 6 mm., *c.* $3\frac{1}{2}$ whorls; apex worn but first 2 whorls and first part of 3rd as in *cidaris*. On later part of 3rd whorl 2 lirae develop, 1 moderately close to the suture, the other a little below midway between suture and upper peripheral keel; on base 2 lirae between lower peripheral keel and the nodulose lira bounding the umbilicus. At diam. 9 mm., 4 whorls, intermediaries have developed. 4 lirae between suture and upper peripheral keel, 1 between the 2 peripheral keels, and 3 on base. At diam. 12 mm., *c.* $4\frac{1}{2}$ whorls, there are 4 lirae on upper surface, 4 on base, and the lira between the 2 peripheral keels is almost as strong as the latter, thus reducing their prominence and making the general profile more evenly convex. Later, an additional lira develops on base, making the total number of lirae on the body whorl 12; all the lirae subequal in strength, including the 2 original peripheral lirae, which however are usually indicated by a series of pale spots.

Umbilicus nearly closed at about diam. 10 mm.; thereafter completely closed, but a rather deep groove remains in the columellar glaze as a 'false umbilicus'.

Alt. 4 at diam. 6 mm., 16 at 20 mm., thereafter altitude increasing proportionately more rapidly: alt. 28 at 32 mm. (cf. Chenu, 1859, fig. 2543); largest seen alt. 37, diam. 39 mm. Krauss gave 14×16.5 lines (of a Paris inch) = approx. 30×35 mm., but his two figures show a diameter of 39 mm.

Operculum as in *sarmaticus*, as mentioned by Krauss; at 8 mm. diam. a subcentral pit is present, which at 10 mm. is almost obliterated by the strong columnar and capitate tubercles.

Iridescence on juveniles maintained up to about 7 mm. diameter.

Tongaat (30 miles north of Durban) (S. Afr. Mus.); Natal (Krauss); as far west as Port Alfred (Turton) and Port Elizabeth (Sowerby). Dead but fresh shells collected at Jeffreys Bay (S. Afr. Mus. coll. Miss Shaw and Miss Lewis).

Durban (Sowerby: *ponsonbyi*).

Fossil: Post-Pliocene, Inhambane (Cox, 1939); Pleistocene, Algoa Bay (Johnson, 1904); Knysna raised beach.

Living: East London (S. Afr. Mus. P.F. coll., and U.C.T.); Port St. Johns (S. Afr. Mus. F. H. Talbot coll.).

Sowerby gave the dimensions of *ponsonbyi* as alt. and diam. 8 mm. His figure as drawn measures alt. 9.5, diam. 12 mm. As the description and figure seem to fit *natalensis*, one or the other of his measurements may be regarded as erroneous. Turton's specimen, however, which he and Tomlin thought might be *ponsonbyi*, had the altitude and diameter approximately equal (1932, p. 176, pl. 41, no. 1245). It does not appear to be subscalariform, but the proportions are certainly different from those of normal *natalensis* at that size.

Turbo sarmaticus Linn.

Figs. 4 a, b, e, f, 5 c

Turbo sarmaticus Linn., Krauss, 1848, p. 101; von Martens, 1874, p. 130; Turton, 1932, p. 175, pl. 41, no. 1240 (juv.).

The protoconch and very early stages are not separable from those of *cidaris*; but from about the 3rd whorl, diam. *c.* 3 mm., squamiform lobules, hollow in front, are developed on the upper (peripheral) and lower keels, slightly larger and more prominent on the former. The submarginal groove on the flat upper surface is distinct on the 2nd whorl, and is traceable on the 3rd, but is so shallow and open as to be scarcely a groove. (Cf. Kesteven, 1902, p. 715, pl. 35, figs. 1-3. *Turbo stamineus*.)

From the end of 3rd whorl a spiral lira develops between the suture and the peripheral keel; thus 3 well-marked keels. The spire becomes more prominent than in *cidaris*, and the profile between suture and the supraperipheral lira is straight or slightly concave. Subsidiary lirae develop, first 1, then 2 above and below the supraperipheral lira, between the peripheral and lower lirae, and also on base between the lower lira and the strong lira surrounding the umbilicus. The basal lirae may increase to 7 or 8, the uppermost (running from top of aperture) being the strongest.

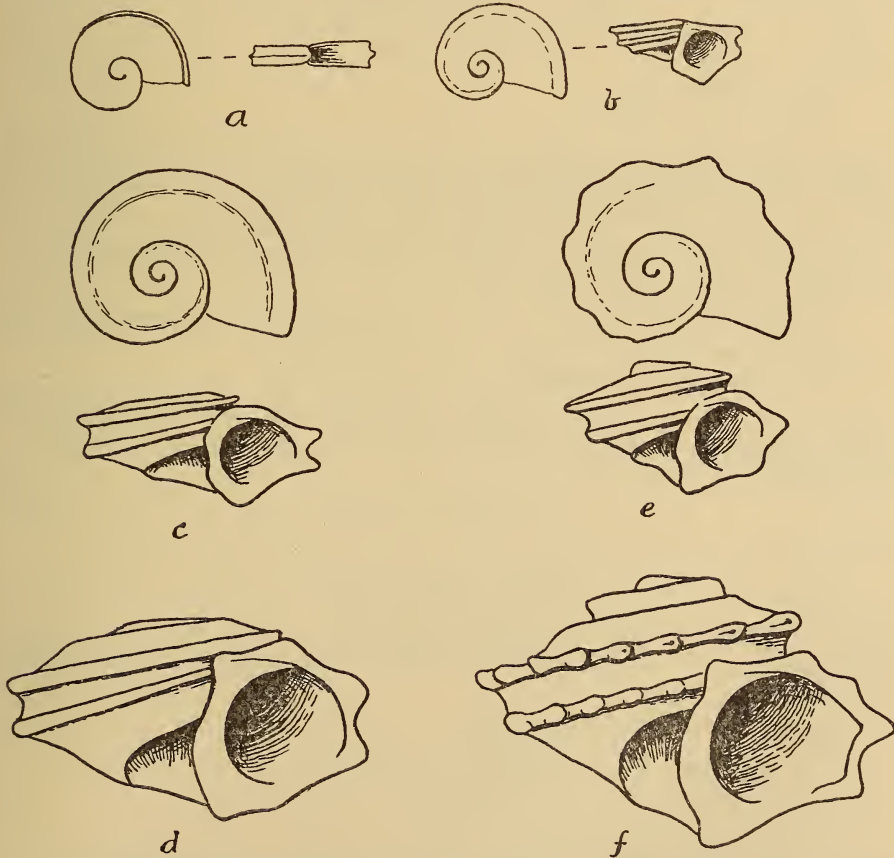


FIG. 4. Juveniles of *Turbo cidaris* Gmelin and *sarmaticus* Linn.: *a*, diam. 0.5 mm. *b*, diam. 2 mm. *T. cidaris*: *c*, diam. 3 mm. *d*, diam. 5.5 mm. *T. sarmaticus*: *e*, diam. 3 mm. *f*, diam. 6.5 mm.

From the 5th whorl the marginal lobules cease to be squamiform, becoming solid nodules. The supraperipheral lira may also develop nodules, and also the uppermost basal lira. Not counting the latter, there may be 2, or sometimes 3, series of nodules; but they vary in prominence, and in the largest shells are evanescent or obsolete.

Size up to alt. 102, diam. 132 mm., $7\frac{1}{2}$ –8 whorls; but in large shells the apex is more or less corroded.

The umbilicus usually remains incompletely closed up to the 5th or 6th whorl (c. 20–25 mm. diam.), but in larger shells is completely covered by the columellar glaze which forms a broad smooth surface without any 'false umbilicus'.

No opercula of shells under 5–6 mm. diam. seen. In a shell 6 mm. diam., the operculum is 1.75 mm. diam. and has a subcentral pit diam. 0.6 mm. in the granulate surface, but no spiral ridge. In opercula of 7–8 mm. diam. the surface is granulate-tuberculate, but the pit, diam. c. 1 mm., remains open. Eventually at c. 12 mm. diam. the pit is completely overgrown by the tubercles, which are closely aggregated, more or less confluent, columnar, the larger ones bi- or tricapitate; in very large opercula they become mushroom-like with multinodulose tops.

Juveniles up to about 3 mm. diam. show a golden iridescence, but this sheen is lost sooner than in *cidaris*, owing it seems to the more rapid thickening of the shell wall. Young shells show much variation in colour and pattern, but old shells become uniform blue-black. From False Bay to Scottburgh (Natal) (*auct. et S. Afr. Mus.*). Off O'Neil Peak (Zululand), 55 fathoms, 1 juv., $2\frac{1}{2}$ whorls (S. Afr. Mus. P.F. coll.).

Remarks. Krauss described the young shell, but not the youngest shells with projecting squamiform nodules.

One Scottburgh shell (coll. K. H. B.), alt. 53, diam. 64 mm., received an injury to the outer lip on the 5th (possibly the 4th) whorl, resulting in a notch, and this is traceable up to the lip on the body whorl (7th) as a Scissurella-like groove.

Turbo petholatus Linn.

Turbo petholatus Linn., Chenu, 1859, i, fig. 2535; Macnae & Kalk, 1958, p. 127 (listed).

Although the apices are worn, specimens in S. Afr. Mus., alt. 30 mm., indicate that the juvenile of 3 whorls, diam. 2.5–3 mm., has projecting peripheral lobules as in *sarmaticus*, thus providing a specific difference, in addition to shape, from *cidaris*.

Delagoa Bay (Macnae & Kalk).

Turbo foveolatus n.sp.

Fig. 6

Shell wall rather thick. Protoconch nucleus plus 3 whorls. Profile convex. Retractive axial piculae and spiral lirae forming a fine clathrate or foveolate

sculpture over whole whorl including base. Spiral lirae 3 on 1st whorl, increasing to 5-6 on 2nd and 8-9 on 3rd; on base *c.* 10-12, the innermost lira stronger than the others, bordering the narrow umbilical chink. Aperture subcircular, columella concave, somewhat expanded at anterior corner. 2.9 × 2.9 mm. Pale buff.

34° 5' S., 25° 42' E., 52 fathoms, 6 dead (S. Afr. Mus. Ag284, P.F. coll.).

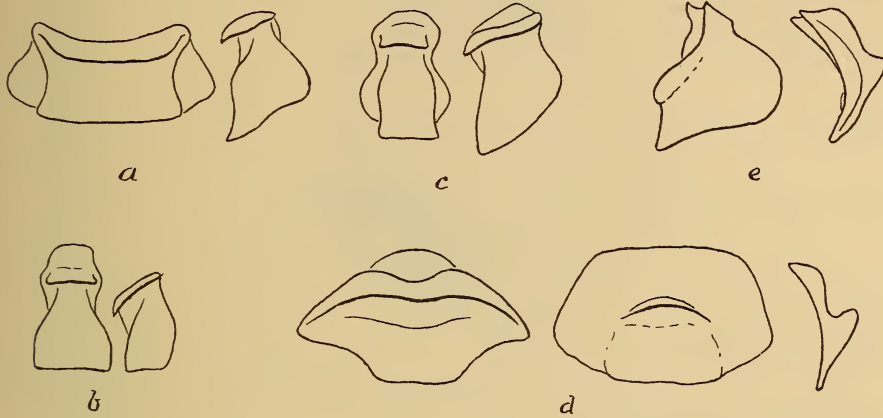


FIG. 5. Central and 1st lateral plates of radula of: *a*, *Turbo coronatus* Gmelin. *b*, *T. cidaris* Gmelin. *c*, *T. sarmaticus* Linn. *d*, *Astraea tayloriana* (Smith), dorsal, ventral, and lateral views of central plate. *e*, dorsal and lateral views of 1st lateral plate.

Remarks. Apparently allied to, and similar in shape to, Thiele's *Turbo* sp. (1925, p. 56, pl. 14 (2), figs. 5, 6) from 34° 51' S., 19° 37' E., 80 metres; but differing completely in sculpture.

Gen. ASTRAEA Bolten-Roding

Thiele, 1929, p. 68.

Thiele divides the genus into several sections, including *Astralium*, *Bolma*,* *Cyclocantha*, *Pachypoma*, *Pomaulax*, under one or other of which the South African representatives have been classed.

Astraea tayloriana (Smith)

Figs. 5 *d*, *e*, 7 *a*, *b*

Turbo (*Pomaulax*) *tayloriana* Smith, 1880, p. 483, pl. 48, fig. 9.

Pachypoma tayloriana Sowerby, 1897, p. 18.

Astrea tayloriana Bartsch, 1915, p. 146.

Astralium tayloriana Odhner, 1923, p. 6; Turton, 1932, p. 176.

Protoconch and 1st postnatal whorl not demarcated. Protoconch nucleus and 2 whorls forming a flat apex; 2nd whorl with a suprapерipheral lobulate

* Smith, Sowerby, Thiele spell the name of Risso's 1826 genus *Bolma*. Watson (1886, p. 131, footnote) said Risso spelt it *Bolina*. The Prussian Academy Nomenclator and also Neave both give *Bolma* as Risso's spelling. In any case *Bolina* seems to have been already preoccupied by Lamarck (1804) and Rafinesque (1815).

keel, continued on 3rd and 4th whorls with the lobes becoming more prominent, squamiform, hollowed in front; *c.* 12 on 2nd whorl, *c.* 14 on 3rd, *c.* 22 on 4th; towards end of 4th whorl decreasing in size and prominence and becoming

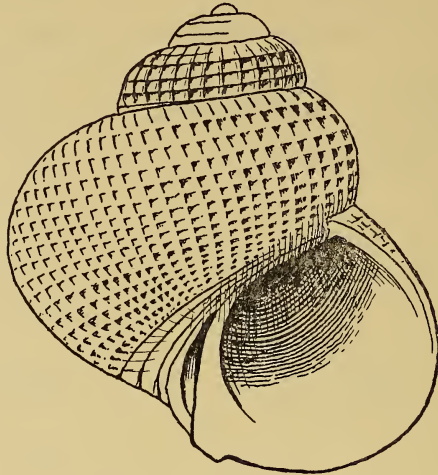


FIG. 6. *Turbo foveolatus* n. sp.

merely solid granules. A second series of squamiform tubercles forms the true periphery and is visible on the 3rd and 4th whorls, the succeeding whorl butting closely up against and sometimes absorbing them. Towards end of 4th whorl these peripheral tubercles diminish and become solid granules.

The groove between these two series of tubercles is prominent on 2nd and 3rd whorls, *appearing* to be the suture, but really forming a 'false suture'. On 4th whorl, however, the groove is clearly distinct from the true suture, but much shallower; on 5th whorl it is still traceable, but on later whorls quite obsolete.

On 3rd whorl 3 spiral series of granules, on 4th 6-7, on 5th 11-12, on 6th whorl *c.* 16, on 7th *c.* 22, 2 or 3 series on the actual periphery slightly larger than the others. On base of 4th whorl 7 series of granules, on 5th whorl 10-11, the 2nd (from the periphery) stronger than the others; on 7th whorl *c.* 16.

In large shells the periphery becomes less strongly angulate.

Four whorls alt. 9, diam. 12 mm.; 5 whorls alt. 14-15, diam. 19-20 mm.; 6 and 7 whorls 40-42 × 47-48 mm., 57 × 67 mm., 65 × 86 mm.

Operculum smooth, slightly concave in middle, 3.5 × 4.5 mm. in 9 × 12 mm. shell; 15 × 21 mm., thickness at inner end 5 mm., in 40 × 48 mm. shell; 25 × 38 mm. in 65 × 86 mm. shell. In young examples there is a trace of a spiral groove at the thin end.

Pinkish or purplish-rose, colour often extending over the periphery on to margin of base; base white, usually with a yellow or orange band near the columellar margin; operculum white. Young shells with darker red flame-like

markings extending retractively from suture above to midway across whorl, or nearly to periphery.

Young shells are clean, but older shells are usually covered with what appears to be a thick brown periostracum, but is really a Hydractinian, probably *Podocoryne carnea* M. Sars (*vide* Dr. Millard, U.C.T.).

Radula with *c.* 70 rows, central plate transversely oblong, resembling a scoop, fixed to the basal membrane by a central lug, 1st lateral plate sub-triangular, fixed to basal membrane by an oblique ridge, and ending in a cutting-edge with 2 tiny points, 3rd-5th lateral plates with slightly more prominent cutting-edge.

Locality unknown (Smith). Port Elizabeth (Sowerby). Port Alfred (Bartsch, Turton). Walker Bay, 24 fathoms (Odhner).

Living: False Bay, 14-40 fathoms (S. Afr. Mus. P.F. coll.); False Bay, 37 and 52 metres (*s.s.* *Africana II*, per U.C.T.).

33° 52' S., 25° 43' E., 52 fathoms 1 fragment; off Cape St. Blaize, 37 fathoms, 2 fragments (S. Afr. Mus. P.F. coll.).

Remarks. Krauss remarked on the contrast between young and old shells of *Turbo sarmaticus*, and here the contrast is equally remarkable. Fortunately the adult was described before the juvenile was known.

The 'false suture' on the early whorls is an important feature for distinguishing young *tayloriana* and *gilchristi*.

It is strange that the *Pieter Faure* took living examples only in False Bay. Elsewhere only 1 fragment was obtained in Algoa Bay, and 2 fragments off Cape St. Blaize. The *Africana II* also obtained it in False Bay.

Thanks to the kindness of Dr. A. J. Cain and Mr. J. Hull, of the University Museum, Oxford, I have been able to examine three specimens from the Turton collection. They are broken and beach-worn, the largest 22 mm. diameter, but Turton's identification is confirmed.

Von Martens (1903, p. 46) recorded two living examples of *Calcar henicum* Watson from 35° 29' S., 21° 2' E., 102 metres, 'agreeing well with Watson's figure'. Were these really *henicum*? At that time von Martens had probably not seen the description of *gilchristi*. The two species are closely similar (*vide infra*), but the locality accords better with the known localities of *tayloriana* than with those of *gilchristi*, the latter not having been found south of Natal.

The *Valdivia* obtained other examples of *henicum* off the west coast of Sumatra, and von Martens remarked that these bridged the gap in the distribution between Fiji (*Challenger*) and the Agulhas Bank. Thiele (1925, p. 57) made no comment on von Martens's identification. Nevertheless I feel that the *Valdivia* examples from the Agulhas Bank should be re-examined before *henicum* is admitted to the fauna-list.

Astraea andersoni (Smith)

Astralium (*Bolma*) *andersoni* Smith, 1902, p. 248, pl. 4, fig. 7.

Astralium (? *Bolma*) *andersoni* Sowerby, 1903, p. 230, pl. 5, fig. 5.

Junction of protoconch and 1st postnatal whorl not distinguishable. At diam. 31 mm. (Smith's Type) there are, if the protoconch is regarded as consisting of nucleus and one whorl, protoconch plus 6 postnatal whorls. By analogy with *Turbo* and *A. tayloriana*, however, I reckon nucleus plus 7 whorls. At diam. 65 mm. (the larger specimen seen by Sowerby) there are nucleus plus $8\frac{1}{2}$ whorls; at diam. 80 mm. nucleus plus $9\frac{1}{3}$ whorls. Nucleus plus 1st and 2nd whorls forming a flat apex.

Sowerby's figure is good, but on the back of the body-whorl not shown in his figure the axial ribs are not only a little stronger but give an impression of being divided into 3 low rounded nodules. On the largest specimen the ribs on the 8th and 9th whorls are strong but less markedly nodulose.

The number of midwhorl (actually slightly below middle of whorl) and peripheral nodules on the 65 mm. diam. specimen are: on 4th whorl 6 and 13, on 5th 12-13 and 15, on 6th and 7th whorls 16 and 15, on 8th 16 and 14; on the 80 mm. diam. specimen they are: on 8th whorl 18 and 15, on 9th *c.* 24 and 17. On the 8th whorl both series of nodules, especially the peripheral series, diminish in size, and on the 9th whorl the midwhorl series is evanescent, the peripheral series much reduced. Sowerby's statement of 10 flattened scales around the peripheral keel on the 65 mm. diam. shell is correct for the three-quarter whorl, from top of the very oblique aperture onwards.

On base about 15 lirae strongly crenulated by the growth-lines.

Operculum drawn in perspective in Sowerby's figure (23×13 mm.); only half of it now remains, but the length was probably about 25 or 26 mm. long, the width is 19 mm., and greatest thickness at inner end 7 mm. The respective measurements of the operculum of the 80 mm. diam. shell are: $35 \times 24 \times 8$ mm.

Size: alt. 57, diam. (incl. projections) 65 mm.; alt. 85, diam. 80 mm. The larger shell is thus proportionately higher, but at diam. 65 mm. was (as far as can be judged) only a little higher (alt. *c.* 60 mm.) than the smaller shell.

Smaller shell dull purplish-pink, becoming on 8th and 9th whorls more fawn or brown; aperture pale, iridescent, columellar glaze orange; operculum white.

The animal in the 80 mm. diam. shell was badly decomposed, but some of the radula plates were secured. The central and lateral plates resemble those of *tayloriana*.

Off Durban (from fish stomach) (Smith). $32^{\circ} 45' S.$, $28^{\circ} 26' E.$ (near Cape Morgan), 36 fathoms, 2 living (Sowerby, P.F. coll.).

Off Port Shepstone, 24 fathoms, 1 living (80 mm. diam.); off Tugela River, 14 fathoms, 1 worn operculum; off Itongazi River, 25 fathoms, 1 worn and corroded juv. (S. Afr. Mus. P.F. coll.).

The type in 1902 was in the collection of 'Mr. Anderson jnr. of Durban' (Smith).

The Cape Morgan specimen figured by Sowerby is in the South African Museum.

Astrea gilchristi (Sow.)

Fig. 7 c

Astralium (*Cyclocantha*) *gilchristi* Sowerby, 1903, p. 221, pl. 5, fig. 6.

Type consisting of the protoconchal nucleus and 6 whorls, alt. 27.5, diam. incl. processes 29 mm. Squamiform nodules on 2nd whorl 10-11, on 3rd and 4th whorls 11-12, on 5th 12-14, on 6th 15-16.

Subsutural granules on 2nd whorl *c.* 22, increasing to *c.* 50 on 6th whorl. On 2nd whorl only 1 (the subsutural) series of granules; on 3rd early part 2, later part 3 series, on 4th later part 4, on 5th 5, later part 6, on 6th whorl 6 series, with an additional somewhat irregular series immediately above the peripheral squamiform nodules. Below the latter 1 series of granules beginning on 5th whorl, on later part 2, but the lower series obscured by suture of following whorl, the 2 series visible on body-whorl from aperture around to outer lip, on back of which they become less distinct.

Basal marginal lira with *c.* 32 squamae on 5th whorl, *c.* 40 on 6th whorl (in neither case a complete whorl, some being obscured by the columellar callus); 6 additional series of granules on base. In the 4-whorled and 5-whorled juveniles there are weak axial ribs between the basal marginal lira and the columella, ending at the latter in a series of feeble granules.

Operculum of Type 10.5 × 9, thickness 5.5 mm., another specimen 12.5 × 11 × 5 mm.; with faint concentric striae (cf. fig. 4 *c* of *bathyraphe*, loc. cit., *infra*), sometimes anastomosing, and in the centre a few faint punctae (Type) or vermiculations.

Off O'Neil Peak (Zululand), 90 fathoms, and off Scottburgh (Natal), 92 fathoms (Sowerby; P.F. coll.).

Off Port Shepstone, 250 fathoms, 1 4-whorled juv.; off Cape Natal, 54 fathoms, 1 5-whorled juv.; off Cape Vidal, 80-100 fathoms, 1 fragment; off O'Neil Peak, 90 fathoms, 3 fragments; off Durnford Point, 90 fathoms, 1 broken, 1 fragment (S. Afr. Mus. P.F. coll.).

Natal (locality number lost), 1 operculum (S. Afr. Mus. P.F. coll.).

Type of *gilchristi*, i.e. the figured Scottburgh example, with Sowerby's autograph label, in the South African Museum (P.F. 12233, S. Afr. Mus. no. A5219).

The O'Neil Peak specimen presumably retained by Sowerby (? now in British Museum).

The Type was returned by Sowerby without the animal, which possibly was passed on to Gwatkin, and the radula may now be in the Gwatkin collection in the British Museum.

Remarks. Smith when describing *bathyraphe* (1899, p. 247, and 1901, pl. 12, figs. 4, 4 *a-c*) did not refer to *henicus* Watson, but Sowerby compared *gilchristi* with *henicus*, without reference to *bathyraphe*.

Sowerby gave two main features distinguishing *gilchristi* from *henicus*: the sutural channel and the more numerous peripheral processes. The first feature,

however, seems to be one in which both species agree. The sculpture separates them: about 12 (13 figured) peripheral processes in *henicus*, 16 in *gilchristi*; the 5th whorl in *henicus* has only the subsutural and supracarinal rows of granules, *gilchristi* has the space between these also granulate. The basal marginal lira in *henicus* has 30–35 sharp vaulted scales becoming stronger towards the lip, in *gilchristi* it has *c.* 40 low vaulted scales becoming less conspicuous; additional lirae on base 10 in *henicus*, 6 in *gilchristi*.

On the other hand, *gilchristi* resembles *bathyraphe* from Maldive Atoll, 210 fathoms, in the sutural channel, basal marginal lira without sharp processes, 6 rows of granules on base, and 2 (see Smith's and Sowerby's figures) rows of granules between the peripheral keel and the suture below. But the peripheral keel has only low vaulted scales in *bathyraphe* in contrast with the sharp processes in *gilchristi*.

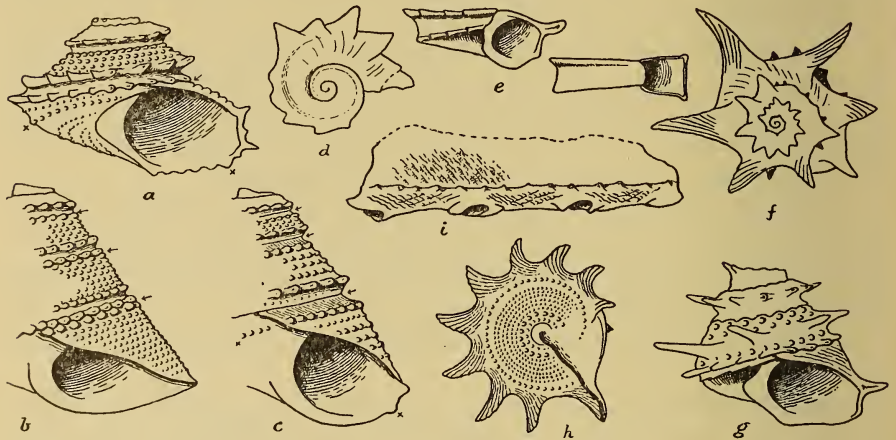


FIG. 7. *a*, *Astraea tayloriana* (Smith) juv. 9×12 mm. *b*, *c*, semidiagrammatic profile of *A. tayloriana* and *A. gilchristi* (Sow.) respectively to show true sutures (arrows) and 'false suture' in the former. *d*, apical view of *Astraea* sp. (S. Afr. Mus. no. A9237) (last process injured near aperture). *e*, lateral view of *Astraea* sp. juv., left: diam. 3 mm. (S. Afr. Mus. no. A9237), right: diam. 1 mm. (no. A9238). *f*, *g*, apical and lateral views of *Astraea* sp. (no. A9236). *h*, basal view of *Astraea* sp. (no. A5217). *i*, fragment of *Astraea* sp. (no. A9233), surface sculpture only partially indicated.

More abundant material may very likely show that *gilchristi* should be relegated to synonymy.

Smith said there were 9 whorls in *bathyraphe*, which seems excessive; probably a misprint for 6 (see Smith's figures).

Astralium johnsoni Odhner (1923, p. 9, pl. 1, figs. 15–17) from Port Alexander, Angola, 60 fathoms, resembles *gilchristi* in having a peripheral series of squamate processes above the channelled suture, but has fewer processes (12 in figure), 5 series of squamose tubercles above the peripheral processes, and only 5 lirae on base.

Astraea sp.

Fig. 7 h

Protoconchal nucleus and 6 whorls. Alt. 19, diam. excl. processes 20 mm. Resembling *tayloriana*, but with steeper spire (alt. 19 instead of 16 at 20 mm. diam.); likewise a supraprochelis series of processes and a peripheral series, with a groove ('false suture') between them; each whorl butting up against the peripheral processes of the preceding whorl. Peripheral keel on 2nd whorl worn; upper series of processes on 3rd and 4th whorls *c.* 12, on 5th whorl *c.* 22, on 6th *c.* 45, at first squamate and prominent, but gradually changing into solid and less prominent nodules; lower (peripheral) series of processes on the other hand becoming more prominent, 12 on 3rd and 4th whorls, 11 on 5th and 6th whorls; the groove between the two series deep on 3rd and 4th whorls, gradually becoming shallower and narrower, and evanescent on last part of 6th whorl.

On 3rd whorl a subsutural series of granules, on 4th whorl 4 series, on 5th 7-8 series, on 6th 10-11 series, on each whorl the subsutural granules larger than the others.

On base a distinct but not very prominent marginal series of *c.* 70 granules; commencing at a short distance within this marginal series 8 series of granules, the 2 next the columella slightly larger than the others.

Sandy Point (north of Kei River mouth), 51 fathoms, 1 dead (S. Afr. Mus. no. A5217, P.F. coll.).

Astraea sp. juv.

Fig. 7 f, g

Protoconchal nucleus and $4\frac{1}{2}$ whorls. Alt. 7.5, diam. excl. processes 7 mm. Apex flat. Second whorl with tiny nodules on upper peripheral keel, becoming gradually stronger, sharp, squamate processes, *c.* 10 on each whorl; lower peripheral keel with more numerous squamate processes, adnate to the succeeding whorl which butts up against them; suture thus undulate, a groove ('false suture') between the 2 peripheral series of processes. Some of the processes on the upper peripheral keel elongated. Base with a marginal slightly squamose lira, and 3 or 4 incipient series of granules.

Off Umkomaas (Natal), 40 fathoms, 1 dead (S. Afr. Mus. no. A9236, P.F. coll.).

Astraea sp.

Fig. 7 i

A fragment of a large *Astraea* from off O'Neil Peak, 55 fathoms (S. Afr. Mus. no. A9233, P.F. coll.) consists of about 50 mm. of the peripheral keel, with about 15 mm. of the surface of the whorl above, and about 10 mm. of the base, including a portion of the columellar glaze.

There are 4 hollow flattened projections (broken) on the keel; if their

distance apart were constant around a shell with diameter of say 70–80 mm., there would have been about 14 processes. Close above these projections there are about 14 small feebly developed squamiform projections. The surface above is crossed by closely-set oblique crenulate growth-lines. Base with finer, straighter growth-lines, no spiral lirae (on the portion preserved).

This is probably a fragment of an Indo-Pacific species, but I have no material for comparison. It may be the adult of the Kei River species (A5217) described above.

Astraea sp. juv.

Fig. 7 *d, e*

A protoconch nucleus plus $1\frac{1}{4}$ whorls, alt. 0.3 (at aperture), diam. 1 mm., with incipient processes on upper keel. 34° S., 25° 44' E., 33 fathoms (S. Afr. Mus. A9238, P.F. coll.).

A protoconch nucleus plus 2 whorls, alt. 1.3 (at aperture), diam. excl. processes 2.5 mm. Off Cape Morgan, 77 fathoms (S. Afr. Mus. A9241, P.F. coll.).

A protoconch nucleus plus 2 whorls, alt. 1.5 diam. excl. processes 3 mm. 34° 5' S., 25° 43' E., 52 fathoms (S. Afr. Mus. No. A9237, P.F. coll.).

There is no doubt that these are the juveniles of one of the species of *Astraea*. They are not so high as juveniles of *Turbo sarmaticus*, the top is quite flat, and the aperture differs in shape. In this last respect the smaller specimen somewhat resembles in shape *Bifrontia zanclaea* Phil. (cf. fig. 102 in Sowerby, 1863, p. 246, pl. 254).

Fam. **Liotiidae**

Thiele, 1929, p. 64 (as subfam. of *Turbinidae*); Laseron, 1954, pp. 1–25, 49 text-figs. (New South Wales species).

There seems to be no sharply defined character separating *Liotia* (as a section of which Thiele regarded *Cynisca*) from *Leptothyra*. Many specimens, e.g. of *C. granulosa*, with an open umbilicus appear to be adult, but are not really so. Consequently this character is not an infallible guide to the genus.

Several species have been instituted in both genera,* mostly on more or less worn material of single or a few specimens; and further study will surely reduce some of them to synonyms. What has hitherto been regarded as speciation may well prove to be only variation. For example, what morphological or sculptural characters (ignoring coloration) are there separating *C. forticostata*, *Cynisca alfredensis* and *Leptothyra africana*? Only variation in the development of the main and intermediary lirae. In fact, examination of fairly extensive material points to *granulosa* being a very variable species. It may even prove to include *forticostata*; but in the meantime the latter is kept separate.

Possibly some of the species described as adults and assigned to this family

* Bartsch most inadvisedly used *africana* and *alfredensis* as specific names in both genera *Cynisca* and *Leptothyra*.

may be only juveniles. Compare for example *Cyclostrema euchilopteron* Melvill & Standen (1903, p. 292, pl. 20, fig. 7) (*Lydiphmis e.* Melvill, 1906, p. 25, pl. 3, figs. 7, 7a) with '*Liotia fulgens*', which is the juvenile of *Turbo cidaris* (see p. 212).

Turton's *Leptothyra subconica* (1932, p. 178, pl. 42, no. 1257) is perhaps a *Tricolia*.

Cynisca granulosa (Krauss)

Fig. 8 a, b, e

Delphinula granulosa Dunker, MS.; Krauss, 1848, p. 94, pl. 5, fig. 28.

Monilea spuria Gould, 1861, p. 17.

Gibbula armillata (non A. Adams) Sowerby, 1892, p. 42.

Leptothyra armillata (non A. Adams) Smith, 1906, p. 53.

Liotia granulosa Krss., von Martens, 1903, p. 46.

Cynisca granulosa Krss., Smith, 1903, p. 388; 1904, p. 38; Thiele, 1924, p. 62, fig. 19 (radula); 1925, p. 54, pl. 13 (1), figs. 35, 36; Turton, 1932, p. 194.

Leptothyra spuria Gld., Bartsch, 1915, p. 146, pl. 22, figs. 4-6.

Leptothyra africana Bartsch, 1915, p. 147, pl. 22, figs. 1-3; Turton, 1932, p. 176, pl. 42, no. 1247 (juv.).

Leptothyra eucosmia Turton, 1932, p. 177, pl. 42, no. 1254 (juv.).

Cynisca gloriosa Bartsch, 1915, p. 163, pl. 31, figs. 6-8; Turton, 1932, p. 194.

Cynisca semiclausa Thiele, 1925, p. 55 and footnote, pl. 14 (2), figs. 1, 2.

Cynisca formosa Turton, 1932, p. 194, pl. 50, no. 1350.

Protoconch nucleus plus $3\frac{1}{2}$ -4 whorls. Spiral lirae on 2nd whorl at first 3, later 4, uppermost lira starting as a series of granules, 2nd lira starting a little later, also granulate; 4-5 lirae on 3rd and 4th whorls, often with an intermediary between 3rd and 4th lirae; all the lirae more or less granulate, sometimes strongly, almost nodulose, the 1st-3rd always granulate (unless worn); sometimes the lirae are strong, separated by narrow sulci, and the granules instead of being subcircular become axially oblong and close together. Base with 4-5 lirae on 2nd whorl, increasing to 6-7 on 4th whorl, the inner 2 or 3 often subgranulate. Growth-lines over upper surface and base distinct in fresh specimens, but only seen in the sulci in worn shells. Umbilicus more widely open in juvenile (2 whorls) than in older shells, the innermost lira being well away from the centre; when adult closed by parietal callus. Adult shells with a few granules within the aperture, near the columella. Alt. 5.5, diam. 7.5 mm.; von Martens 6 x 9 mm.

Cream, pinkish, carmine, russet-brown, purplish-brown, speckled, spotted, mottled, or with radial streaks.

Operculum with close-set, finely beaded calcareous spiral lirae.

Radula with c. 50-60 rows, central plate broad, front margin turned over, ventral surface with cross-bar, 5 lateral plates with small triangular cusps, expanded basally, marginal plates uncinata.

Table Bay to Port Alfred (*auct. et S. Afr. Mus.*). Port Natal (Durban) (Thiele). One specimen from Tongaat (Natal) (S. Afr. Mus.).

Off Cape Morgan, 25 fathoms, 1 dead; off Cove Rock (East London) 22 fathoms, 20 dead; off Keiskamma Point, 33 fathoms, 4 dead; Algoa Bay, 33 fathoms, 5 juv. dead (S. Afr. Mus. P.F. coll.).

Living: Lüderitzbucht, Buffels River (south of Port Nolloth) to Saldanha Bay; and Cape Hangklip to Cape Agulhas (U.C.T.).

Remarks. A fine intermediary lira may be present between the 1st and 2nd, the 2nd and 3rd, and the 4th and 5th lirae, and between the lowest lira and the outermost basal lira, as well as between the 3rd and 4th; but not all concomitantly are present in one shell.

Bartsch's *gloriosa* appears to be merely a strongly granulate variation; there are two similar specimens among the Cove Rock set. Turton's *formosa* has intermediaries. Turton's photo of *eucoxia* has been badly retouched.

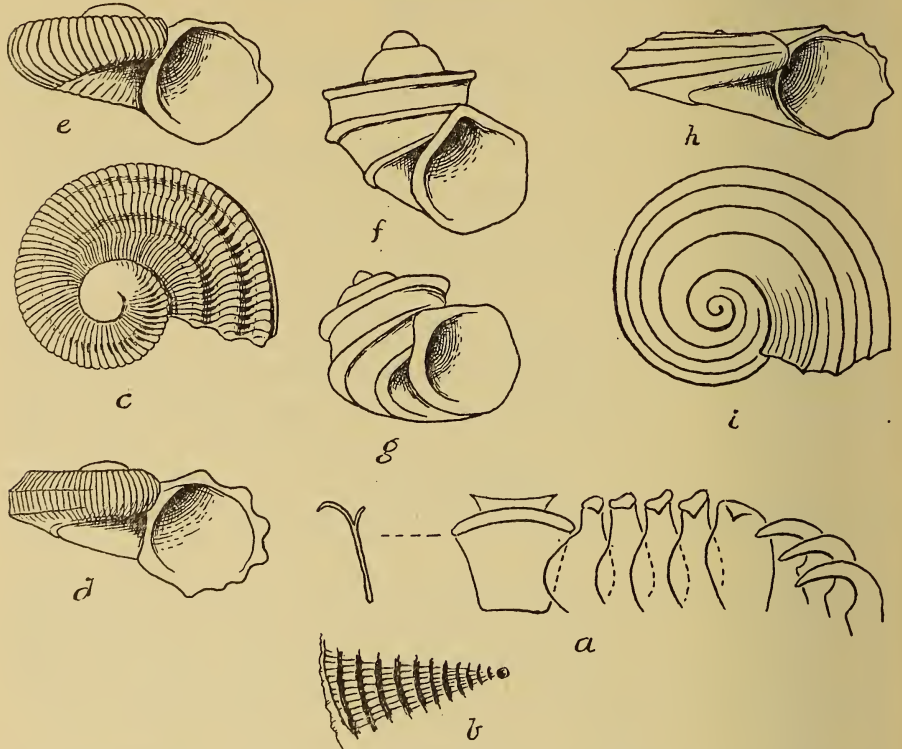


FIG. 8. *Cynisca granulosa* (Krss.) a, radula plates, with section of central plate; b, portion of operculum. *Cynisca* sp. juv. c, d, apical and lateral views (no. A6566). *Cynisca granulosa* (Krss.) e, lateral view of juvenile. *Leptothyra atomus* Turton f, g, lateral and oblique basal views. *Liotia* sp. h, i, lateral and apical views (no. A9280).

It is clear that Krauss figured the immature shell with open umbilicus, whereas Bartsch's figure of Gould's cotype shows the fully adult non-perforate shell. *C. semiclausa* is the half-way stage. Sowerby (1889b, p. 152) remarked on the umbilicus being open or closed. Worn adult shells often appear to be perforate because the parietal callus is thin and easily broken away.

Thiele suggested that his *semiclausa* might be the same as *L. africana*, and considered it to be a *Cynisca*.

Cynisca forticostata Smith

Cynisca forticostata Smith, 1904, p. 38, pl. 3, figs. 12, 13; Bartsch, 1915, p. 163; Turton, 1932, p. 194, pl. 49, no. 1348.

Cynisca alfredensis Bartsch, 1915, p. 164, pl. 29, figs. 10-12; Turton, 1932, p. 194.

Cynisca africana Bartsch, 1915, p. 165, pl. 28, figs. 4-6; Turton, 1932, p. 195. (= juv.).

Protoconch smooth. Postnatal whorls $3\frac{1}{2}$ -4. Spiral lirae 2 on 1st whorl, the upper one granulate, on 2nd whorl this upper lira becomes the 2nd lira, and a subsutural lira begins, feebly granulate at start but granules becoming stronger, on 3rd and 4th whorls all three lirae are strong with well-marked granules; an intermediary may develop between 1st and 2nd and between 2nd and 3rd lirae; on base 3 granulate lirae on a 2-whorled specimen, 4 on an adult, increasing to 6 if intermediaries are developed. The outermost lira on upper surface forms the periphery, but the outermost basal lira is sometimes equally strong and prominent. Growth-lines (in unworn shells) well marked from the 1st whorl onwards, pliculose, crossing the lirae but leaving the granules smooth and polished; base similarly sculptured. Sutures deep. Umbilicus deep, remaining open in large shells. No granules within the aperture. Alt. 6, diam. 8 mm.

The U.C.T. specimen from a depth of 84 metres fawn with darker spots on the lirae between the paler granules. Beach-worn specimens white, with or without a few scattered pink or brown spots.

Operculum with close-set, finely beaded calcareous spiral lirae.

Radula with *c.* 50-60 rows, as in *granulosa*.

Port Alfred (Smith, Bartsch, Turton; also S. Afr. Mus.).

Off Nieca River (East London area) 43 fathoms, 2 dead; off Tugela River (Natal) 65-80 fathoms, 1 juv. dead (S. Afr. Mus. P.F. coll.).

Off East London ($33^{\circ} 9' S.$, $28^{\circ} 2' E.$), 84 metres, 1 living (U.C.T.).

Remarks. The pliculose growth-lines and the granules on living shells from the littoral zone form a pleasing sculpture, but are particularly beautiful on the U.C.T. specimen.

Cynisca sp.

Fig. 8 *c, d*

Heliacus sp. juv. Tomlin, 1928, p. 334.

Diam. 1.5 mm. This may perhaps be the juvenile of *Cynisca forticostata*. It has a lira in the middle of the whorl showing at the start of the 1st whorl, immediately following the protoconchal nucleus; on the 2nd whorl a second lira appears between it and the suture. In *granulosa* no lira appears until the 2nd whorl (S. Afr. Mus. A6566, P.F. coll.).

This distinction, however, needs confirmation, because no unworn juvenile of *forticostata* is available.

Leptothyra alfredensis Bartsch

Leptothyra alfredensis Bartsch, 1915, p. 149, pl. 32, figs. 1, 2, 3.

Cynisca rufanensis Turton, 1932, p. 194, pl. 50, no. 1353.

Protoconch nucleus plus 4 whorls. Spiral lirae 2 on 2nd, 3 on 3rd whorl, but the 3rd (peripheral) lira concealed in the suture and only becoming visible towards the middle of 4th whorl when the aperture drops down; very fine spiral striae between the narrow lirae; on base 3 lirae. Growth-lines pliculate, distinct between all the lirae, including base. Umbilicus open. Alt. 5, diam. 5 mm.

Cream-coloured.

Port Alfred (Bartsch, Turton). Still Bay (S. Afr. Mus. coll. Muir).

Remarks. Dr. Muir obtained numerous examples but unfortunately none smaller than 1.5 mm. diam.

Leptothyra atomus W. H. Turton

Fig. 8 f, g

Leptothyra atomus Turton, 1932, p. 177, pl. 42, no. 1253.

This may be the juvenile of *alfredensis*, but specimens of the latter less than 1.5 mm. diam. are required to prove it. Dr. Muir obtained at Still Bay some minute shells, 0.6 × 0.6 mm., similar to Turton's shells. Turton's description does not mention the number of basal lirae; his photo has been retouched with ink, and in any case is not very clear; I think each of the two lower pairs of lines represents one lira, as in the present figure, drawn approximately in the same perspective as Turton's photo.

Liotia (Cynisca) bicarinata (von Martens)

Collonia bicarinata von Martens, 1902, p. 241.

Liotia bicarinata von Martens, 1903, p. 46, pl. 5, fig. 4.

Cynisca bicarinata Thiele, 1925, p. 55.

Apex broken, 1st and 2nd (or 2nd and 3rd) whorls with 1 spiral lira, last whorl with 2 lirae, 1 in middle of whorl and 1 peripheral; base with 2 lirae. Growth-lines distinct but fine. Umbilicus open. Alt. 6, diam. 9 mm.

35° 10' S., 23° 2' E., 500 metres (von Martens).

Not taken by the *Pieter Faure*. Distinguished from *Leptothyra alfredensis* by having only 2 lirae on the body-whorl, and the much finer growth-lines.

Leptothyra quantilla (Gould)

Collonia quantilla Gould, 1861, p. 22.

Turbo sanguineus (non Linn.) Sowerby, 1892, p. 42.

Leptothyra sanguinea (non Linn.) Smith, 1904, p. 24.

Leptothyra quantilla (Gould) Bartsch, 1915, p. 148, pl. 23, figs. 4-6.

? *Leptothyra agulhasensis* Thiele, 1925, p. 56, pl. 14 (2), fig. 4.

? *Leptothyra quantilla* (Gould) Turton, 1932, p. 177.

Leptothyra carminea Bartsch

Leptothyra carminea Bartsch, 1915, p. 148, pl. 23, figs. 7-9.

? *Leptothyra quantilla* (Gould) Thiele, 1925, p. 55, pl. 14 (2), fig. 3.

The normal number of lirae on upper part of last whorl seems to be 6; in *carminea* 5 is also frequent, and there may be only 4; on the other hand in *quantilla* there may be 7 or 8.

The basal lirae normally number 6 in *carminea*, but there may be occasionally 5 or 7; in *quantilla* 10–12 seems to be normal. Bartsch gave 15 for Gould's Type, but his figure does not show more than 12 or 13; I have not seen any shell with more than 12 basal lirae; in fact 10 seems to be more common. Thiele (p. 55) gave a total of 15 lirae on the last whorl of a 2.5 mm. diam. shell, the lowermost 5 of which were weak and close together.

The uppermost one or two lirae may show weak granulation, as also the lira surrounding the umbilicus. These features were mentioned by Thiele for *agulhasensis*.

In 1-whorled and 2-whorled juveniles there is a faint ridge (not keel) on base, within which the surface slopes down into the umbilicus; it forms a slight angularity on the lower margin of the aperture.

The umbilicus always remains open, though it may be slightly narrowed by encroachment of the parietal callus.

The pink colour begins on the lirae at the end of 2nd whorl, but later extends to the grooves; in beach-worn adults the colour is retained longer in the grooves than on the lirae. U.C.T. specimens kept in alcohol since 1932 are bleached nearly white. Turton's white examples seem to belong to another species, judging by examples sent by him to the South African Museum (see *rotundata*).

Up to alt. 3, maj. diam. 3.5 mm.

Operculum calcified, spiral growth visible internally, external surface slightly concave, with central pit, overlap of last whorl onto previous whorl not strongly marked, a slight calcareous thickening along inner margin (see fig. 9 c, as shown by dotted line).

Radula with c. 50 rows, similar to that of *Cynisca granulosa*.

quantilla: False Bay (Gould; also S. Afr. Mus.); Still Bay, juveniles from 0.75 mm. upwards (S. Afr. Mus. coll. Muir); Algoa Bay (Sowerby); Port Alfred (Smith, Bartsch).

Still Bay and Knysna (U.C.T.).

carminea: Port Alfred (Bartsch; also S. Afr. Mus.).

Algoa Bay, 33 fathoms, 3; off Sandy Point (north of Kei River mouth) 95 fathoms, several; off Cove Rock (East London), 22 fathoms, 9; off Cape Morgan, 47 fathoms, 1; all dead (S. Afr. Mus. P.F. coll.).

31° 51' S., 19° 37' E., 80 metres, 1 bleached (Thiele: *agulhasensis*).

Distribution. Great Fish Bay (Angola) (Thiele: *quantilla*).

Remarks. For the present, two names may be retained for the extreme forms of what may prove to be a single species. The material at hand shows that *quantilla* is found in the western area, from False Bay to Algoa Bay, and extending to Port Alfred; and *carminea* in the eastern area from Algoa Bay eastwards. The two forms seem to commingle in the Algoa Bay–Port Alfred area. More material, and investigation of the northward range beyond Cape Morgan, are desirable.

Thiele said the shell described by Bartsch might belong (*dürfte gehören*) to *quantilla* Gould. In fact Bartsch redescribed Gould's Type! Thiele's fig. 3 of an Angolan shell appears to resemble the *carminea* form (with few basal lirae), whereas his fig. 4 of *agulhasensis* is more like the *quantilla* form (with numerous basal lirae).

I am doubtful about including *agulhasensis* in the synonymy because it is based on a shell 4×4.5 mm., which is appreciably larger than the largest shell (3×3.5 mm.) in the present material.

Turton's *Cyclostrema problematica* (1932, p. 198, pl. 51, no. 1378) looks very like a juvenile *quantilla*.

Leptothyra rotundata (Sow.)

Fig. 9 a-d

Turbo minutus (non Michaud) Sowerby, 1889 b, p. 152, pl. 3, fig. 9; 1892, p. 42, pl. 2, fig. 54.

Cyclostrema minuta Sow., Turton, 1932, p. 199, pl. 52, no. 1383.

Cyclostrema rotundata Sowerby, 1892, p. 45, pl. 2, fig. 47.

Cyclostrema rotundata Sow., Tomlin, 1923, p. 50.

? *Cyclostrema rotundata* Sow., Turton, 1932, p. 199, pl. 51, no. 1381.

? *Cyclostrema inconspicua* Turton, 1932, p. 199, pl. 51, no. 1382.

Distinguished from *quantilla* by its uniform white or yellowish colour (not pink or pink striped), and by the umbilicus being closed in the adult.

Lirae on upper part of last whorl 6-7, on base 12-15.

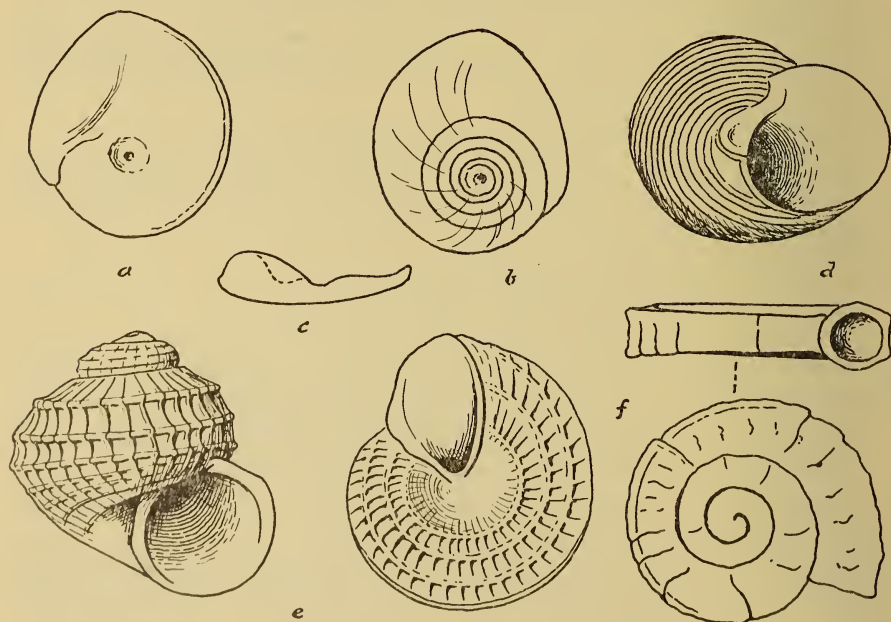


FIG. 9. *Leptothyra rotundata* (Sow.) a, b, c, external and internal views of operculum, with section. The dotted line in c refers to *quantilla*. d, basal view. *Leptothyra sola* n. sp. e, lateral and basal views. *Rufanula sextula* n.g., n. sp. f, lateral and apical views.

Umbilicus open on 2-whorled and often on $2\frac{1}{2}$ -whorled shells, but closed on 3-whorled shells; the filling is at first a button-like plug, but usually this is covered with a smooth callus, sometimes with a slight concavity forming a false umbilicus.

Operculum as in *quantilla*, but with a larger, more boss-like thickening on inner margin. It has a close resemblance to the operculum of *Bothropoma* (Thiele, 1929, fig. 46).

Radula with c. 45-50 rows, similar to that of *Cynisca granulosa*.

Diam. 3 mm. White, cream, yellowish, the apical part sometimes rusty brown.

Port Elizabeth (Sowerby). False Bay (S. Afr. Mus.); Port Alfred (S. Afr. Mus., 3 sent by Turton as white *quantilla*); west coast of Cape Peninsula (S. Afr. Mus.).

Algoa Bay, 33 fathoms, 4; off Cape Morgan, 47 fathoms, 2 (S. Afr. Mus. P.F. coll.).

East London (U.C.T.).

Leptothyra sola n.sp.

Fig. 9 e

One specimen, probably juvenile, from the *Pieter Faure* collection, without locality, but probably from Algoa Bay. Similar to *alfredensis* but with fewer axial pliculae (c. 33 on 3rd whorl), and with 4 spiral lirae on base. Alt. 1.5, diam. 1.75 mm. (S. Afr. Mus. A9288, P.F. coll.).

Less strongly lirate, and with more numerous axial pliculae, than *Euchelus natalensis* (p. 266).

Liotia sp.

Fig. 8 h, i

Protoconch nucleus plus 2 whorls. Discoidal, protoconch scarcely projecting above level of 2nd whorl. First whorl with 1 weak lira, at end of whorl 2 lirae, 2nd whorl with 4, the upper one raised above level of suture, the 4th peripheral and carinal, 1 intermediary between 1st and 2nd, and 1 between 2nd and 3rd lirae, in addition 5-6 fine spiral striae between suture and 1st lira; on base fine spiral striae and 1 well-marked lira, a feeble lira marks the entrance to the wide open umbilicus. No axial sculpture. Aperture circular. Alt. 1.25, diam. 3 mm.

Off Nieca River (East London area), 47 fathoms, 1 dead (S. Afr. Mus. A9280, P.F. coll.).

Teinostoma africanum (Smith)

Teinostoma lucidum (non Adams) Sowerby, 1892, p. 13.

Ethalia africana Smith, 1904, p. 38, pl. 3, figs. 10, 11.

Teinostoma africana Bartsch, 1915, p. 165.

Teinostoma alfredensis Bartsch, 1915, p. 165, pl. 28, figs. 7-9; Turton, 1932, p. 195, pl. 50, no. 1358.

Both *africanum* and *alfredense* came from the same locality, and appear to have been based on worn and unworn examples, respectively, of the same species.

Cyclostremella africana Bartsch

Cyclostremella africana Bartsch, 1915, p. 170, pl. 29, figs. 1, 2, 3.

The Type specimen was 2.1 mm. diameter with 3 (though Bartsch gave $2\frac{1}{2} + 1\frac{1}{2}$) whorls. The present specimen is 3.3 mm. with 4 whorls. Yellowish with a subsutural series of faint white spots on the last whorl.

Port Alfred (Bartsch, Turton). Still Bay, 1 (S. Afr. Mus. Muir coll.).

Remarks. The true systematic position of this species is uncertain until the animal has been examined.

Rufanula n.g.

Planorboid, spire and base concave, the latter more so than former, last whorl not disunited, Peristome complete.

Genotype: *R. sextula* n.sp.

Without the animal, the family position is uncertain, though the species might perhaps be included in the New Zealand *Zerotula*. Nevertheless it may be given a definite generic status. The name is derived from Sir Rufane Donkin, whose monument in Port Elizabeth overlooks Algoa Bay.

Rufanula sextula n.sp.

Fig. 9f

Whorls 3. Upper and lower surface of last whorl slightly convex, but not costate, bounded by a slight blunt keel, the periphery between the keels flat or slightly concave. Peristome subcircular, flattened at the outerlip; aperture circular. Some of the growth-lines, at irregular intervals, subvaricoid, causing slight irregularities in the outline. 1.5 × 0.3 mm. Corneous.

34° S., 25° 44' E. (Algoa Bay) (depth not recorded, but probably about 30 fathoms), 3 (S. Afr. Mus. A29634, P.F. coll.).

Remarks. The shell can be stood up firmly on its edge like a tiny coin.

It has a strong resemblance to *Bifrontia zanclaea* Phil., as figured by Sowerby (1863, p. 246, pl. 254, figs. 101-103). *Bifrontia*, seemingly a fossil genus, is not included in Thiele's *Handbuch* (1929).

Somewhat similar shells are: the Philippine *Daronia spirula* A.Ad. (Sowerby, 1864, pl. 255, figs. 32, 33), and the Australian *Liotella parvirota* Laseron (1954, p. 9, figs. 19, 19a) and *Orbitestella aura* Laseron (1954, p. 18, figs. 44, 44 a, b). The two former are loosely coiled, but not the latter. None of them, however, has a flattened periphery.

Easily distinguished from juvenile *Turbo cidaris* (fig. 4 c), and the juvenile Astracid (S. Afr. Mus. A9238) described on p. 224 (fig. 7 e).

Fam. **Trochidae***Minolia splendens* (Sow.)

Fig. 10 a

Solariella splendens Sowerby, 1897, p. 18, pl. 6, fig. 21.

Minolia splendens Thiele, 1925, p. 53.

Protoconch nucleus plus 5 whorls. Profile with tabulate shoulder. Spiral lirae 2 on 2nd and 3rd whorls, 4 on 4th, 7 (8) on 5th, the uppermost lira forming the shoulder, feebly granulate on 2nd and 3rd whorls, sometimes also on 4th but not on 5th whorl, 1 or 2 finer lirae on the tabulate zone; base smooth. Umbilicus wide, with 3-4 inconspicuous lirae, crossed by axial growth-lines. Up to alt. 8, diam. 10.5 mm.

Radula with *c.* 30 rows, central and lateral plates thin, quadrangular, anterior margins very slightly turned over, marginal plates very numerous, inner ones at first very similar to the laterals, but gradually becoming falcate with broader shaft and biserrulate cusp, then gradually passing into the very fine and slender outer series.

Natal (Sowerby); Durban (S. Afr. Mus.).

Off Umhloti River (Natal), 27 fathoms, 1 living, 5 dead; off Umhlanga River (Natal), 22-26 fathoms, 3 dead; off Cape Vidal (Zululand), 22 fathoms, 2 dead (S. Afr. Mus. P.F. coll.).

Remarks. The *Pieter Faure* obtained only 1 living example, the others dead but fresh. The radula confirms Thiele's statement that the species is a *Minolia*.

Minolia articulata (Gould)

Margarita articulata Gould, 1861, p. 15.

Trochus (Solariella) dilectus (? non Adams) Sowerby, 1889 b, p. 154.

Solariella dilecta (? non Adams) Sowerby, 1892, p. 44, pl. 4, fig. 90.

Gibbula articulata Bartsch, 1915, p. 155, pl. 25, figs. 4-6.

Solariella algoensis Thiele, 1925, p. 50, pl. 13 (1), fig. 21.

Minolia bleeki Thiele, 1925, p. 53, pl. 13 (1), fig. 32.

Protoconch nucleus plus 4 whorls. Spiral lirae on 1st whorl 1 (= the uppermost lira on following whorls), weak, on 2nd whorl at start 2, later 3; on 3rd 3 (4); on 4th 4 (5); the uppermost lira separated from suture by a tabulate shoulder; a 5th (6th) lira close below periphery not visible in apical view, and thus reckoned to be on base; intermediaries may be developed. Base with 8-10 spiral lirae, strongest near the umbilicus. Growth-lines forming regular close-set pliculae; varying in strength, especially well marked on the tabulate shoulder; continued across base and well marked in umbilicus. Alt. 8, diam. 9 mm.

White, buff, pink, sometimes nearly unicolorous, usually with radiating axial flames, comma-shaped marks on the tabulate shoulder, spotted or speckled, lirae often articulate, base with more or less well-marked axial streaks. Sometimes dark brown with pale spots around periphery.

Radula with *c.* 35-40 rows, similar to that of *splendens*.

Fossil: Quaternary; Sedgefield near Knysna (A. R. H. Martin).

Simon's Bay (False Bay) (Gould, Thiele); Port Elizabeth (Sowerby); Algoa Bay (Thiele); Port Alfred (Bartsch, Turton); False Bay (S. Afr. Mus.).

False Bay, 22-25 fathoms, numerous; off Cape St. Blaize, 37 fathoms, 1 dead; 34° 5' S., 25° 55' E., 67 fathoms, 4 dead; off Keiskamma Point, 33 fathoms, 1 dead; off Cove Rock (East London), 22 fathoms, 4 dead (S. Afr. Mus. P.F. coll.).

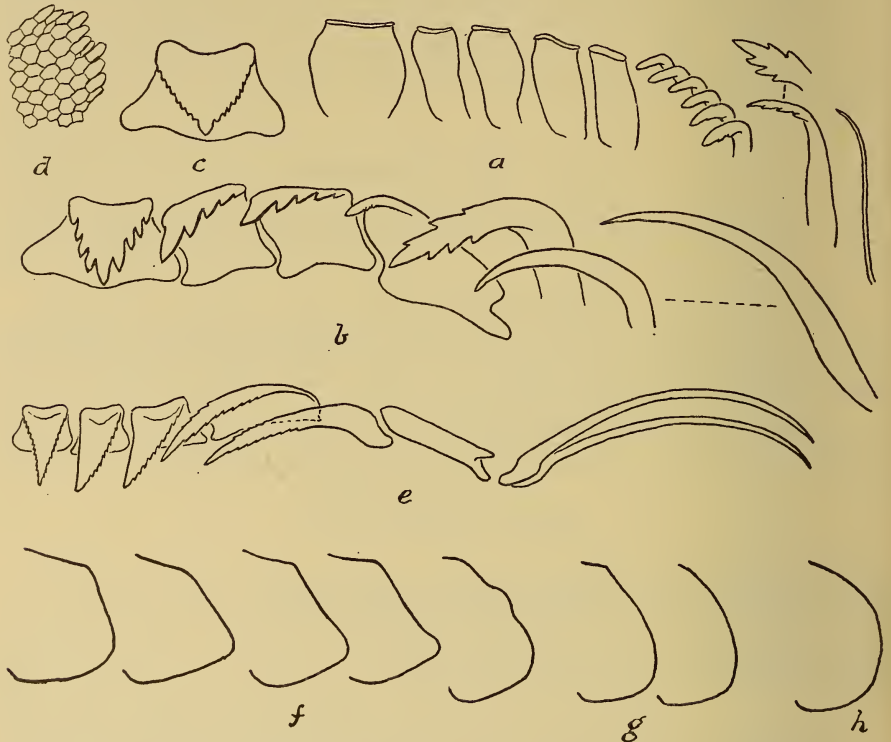


FIG. 10. *Minolia splendens* (Sow.) a, radula plates. *Solariella undata* Sow. b, radula plates. d, portion of jaw. *S. laevisissima* (v. Mrtns.). c, central plate of radula of no. A5266. *S. franciscana* n. sp. e, radula plates. Profiles of: f, *S. undata*, five variations; g, *S. agulhasensis* Thiele, two variations; h, *S. multistriata* Thiele.

False Bay, living (U.C.T.). 34° 16' S., 22° 17' E., 73 metres, 1 living (U.C.T.).

Remarks. Thiele rightly by-passed '*dilecta*'; he was undecided whether his *algoensis* was identical with *articulata*. Sowerby's figure of '*dilecta*' is poor, and although S. Afr. Museum specimens were identified by J. H. Ponsonby as *dilecta*, no recent comparison, so far as I am aware, has been made of South African specimens with Adams's Type. The Cumingian locality 'Magellan Straits' may be incorrect.

Gould's species, as illustrated by Bartsch, is unmistakable, and *algoensis* is undoubtedly synonymous. Very common in False Bay, and extends eastwards to the East London area.

The growth-lines vary in strength, being sometimes very fine and close-set, but usually plicate and well marked. Beach specimens usually show them only on the tabulate shoulder (if at all). When well developed they may impart a slight beading to the shoulder lira.

One of the P.F. specimens from Algoa Bay has intermediary lirae: 1 on the tabulate shoulder on 3rd and 4th whorls, and 1 between each pair of lirae on 4th whorl. The 3-whorled U.C.T. specimen (34° S., 22' E.) has an intermediary on the tabulate shoulder on 2nd and 3rd whorls, but no intermediaries between the other lirae.

The West African shell described and figured by von Martens (1903, p. 15, pl. 5, fig. 7), and doubtfully identified as *Minolia dilecta* A. Adams, is not the same as the South African shell formerly known as '*dilecta*'. See Thiele (1925, p. 53, pl. 13(1), fig. 31): = *bojadorensis* Thiele.

Minolia adarticulata n.sp.

Fig. 11 f

Protoconch plus $5\frac{1}{2}$ whorls. Turreted, profile convex, with tabulate shoulder. Sutures indented. Spiral lirae obscure on 1st whorl (a faint indication of the shoulder lira on later part of whorl), on 2nd whorl 3, 4 at end of whorl, 4 lirae on 3rd, 4th, and 5th whorls, the uppermost lira forming the rather sharp shoulder; fine spiral striae and intermediary lirae may occur on the tabulate shoulder and between the main lirae; on base 7 spiral lirae in one specimen, 10 in the other owing to intermediaries, 4 or 5 within the widely open umbilicus. Growth-lines forming retractive pliculae on the tabulate shoulder only, but producing a feeble beading on the shoulder lira, and sometimes on the early whorls, continued faintly in the sulcus below shoulder. Aperture circular. Alt. 8.5, diam. 8 mm., also 8×8 mm.

One shell buff, the other fawn with pink dots on the lirae, on upper part of whorls and on base.

Off Hood Point (East London), 49 fathoms, 2 dead (S. Afr. Mus. A9277, P.F. coll.). Also off Cape Natal (Durban), 85 fathoms, 2 fragments (S. Afr. Mus. P. F. coll.).

Remarks. Definitely a higher shell than *articulata*, but otherwise not dissimilar. The axial pliculae, however, which in the latter are very distinct across all the sulci, are here developed only on the tabulate shoulder.

The two fragments from Natal appear to be conspecific, having fine striae between the lirae, and pliculae only on the tabulate zone.

In the absence of the radula, provisionally assigned to *Minolia* on account of its resemblance to *articulata*.

Minolia sp.

Protoconch nucleus plus $3\frac{1}{4}$ whorls. No spiral lirae above the periphery; below the periphery on base *c*. 10 feebly impressed spiral striae (seen only on part of base, elsewhere worn or corroded). Growth-lines fine, non-plicose, but at irregular intervals accentuated by corrosion. Umbilicus narrow. Alt. 2.5, diam. 3.2 mm. White.

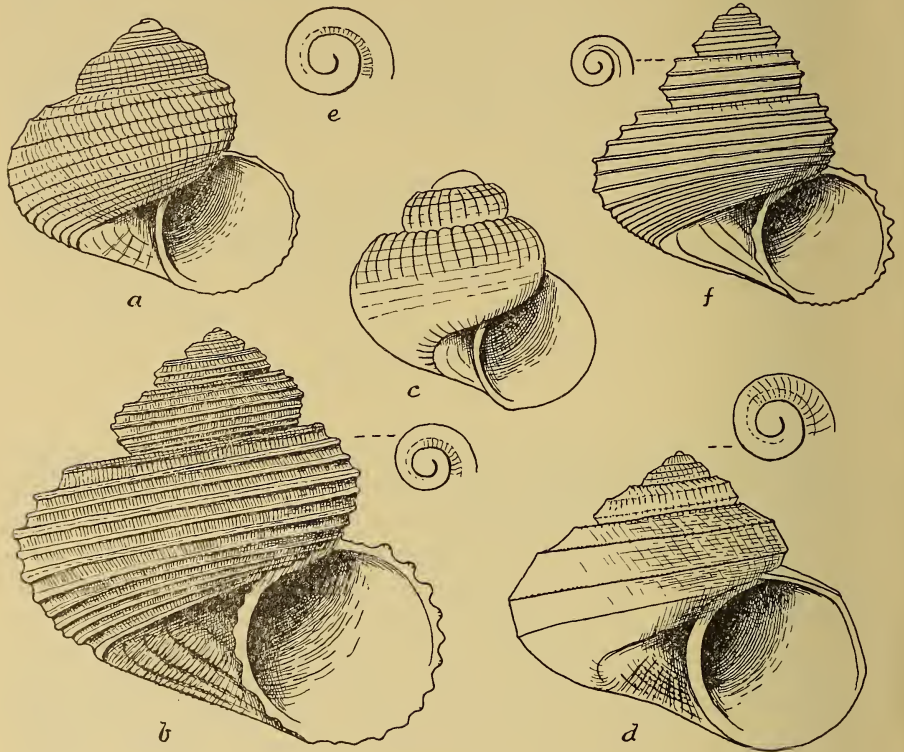


FIG. 11. *a*, *Solariella turbynei* n. sp. *b*, *S. franciscana* n. sp. *c*, *S. macleari* n. sp. *d*, *S. gilchristi* n. sp. *e*, *Solariella* sp., protoconch. *f*, *Minolia adarticulata* n. sp. (*e* is drawn to the same scale as the other protoconchs, but the shells are drawn to different scales).

Radula similar to that of *splendens*, about 25 rows (not easily countable).
32° 5' S., 18° 16' E., 20 fathoms, 1 living, 1 dead (U.C.T.).

Differing from *articulata* in having no sculpture above the periphery, and a narrower umbilicus. Moreover *articulata* has not been recorded from the west coast.

Solariella undata Sow.

Fig. 10 *b*, *d*, *f*

Solariella undata Sowerby, 1870, p. 251.

Minolia undata von Martens, 1903, p. 47, pl. 5, fig. 5.

Solariella valdiviae Thiele, 1925, p. 47, pl. 13 (1), fig. 15.

Protoconch nucleus plus 5 whorls. Whorls with a slight but distinct shoulder a little above midway between periphery and suture, periphery feebly angular, less so in adult than in juvenile. Fine close striae over whole whorl including base, with stronger lirae around and within umbilicus. Growth-lines fine, distinct (at least below suture), usually distinct on base and forming radiating pliculae entering the umbilicus. Alt. 9, diam. 15 mm.

Buff or fawn, with large fulvous patches or comma-like flames between suture and shoulder, fine undulate or zigzag streaks below shoulder, periphery with oblique irregular flames; sometimes almost unicolorous.

Jaws reticulate. Radula with *c.* 28 rows, central plate laterally expanded, wider than long, with strong cusp bearing 4 (5) serrations on both margins, 1st and 2nd lateral plates slightly broader than long, strongly serrate on outer margin, 3rd lateral much broader than long, with small cusp bearing minute denticles, marginal plates not numerous, 1st strong, serrate on both margins, following plates sickle-shaped, non-serrate.

Agulhas Bank (Sowerby). 35° 16' S., 22° 26' E., 155 metres, several, 1 fresh; 34° 33' S., 18° 21' E., 318 metres (von Martens).

Off Umhloti River (Natal), 40 fathoms, 5 dead; off East London, 300 fathoms, 1 dead but unworn; off Cove Rock (East London), 80–130 fathoms, 5 dead; 36° 40' S., 21° 26' E., 200 fathoms, 3 dead; Brown's Bank (approx. 36½° S., 20½° E.), 80–100 fathoms, 5 dead; off Cape St. Blaize, 125 fathoms, 4 dead, and 90–100 fathoms, 1 living; off Cape Point and west coast of Cape Peninsula, 120–145 fathoms, 3 dead (one of them fresh) (S. Afr. Mus. P.F. coll.).

30° 42' S., 15° 59' E., 201 metres, 2 living (s.s. *Africana*, per U.C.T.).

Remarks. The prominence of the shoulder and the peripheral angulation show variation even among only two dozen examples (fig. 10 *f*). Both may be so faint, especially on the last whorl in adults, that the shell almost resembles *laevissima* except for the spiral striae. The profile may be distinctly concave above the peripheral angulation, making the periphery almost carinate (*valdiviae*); there may be a slight convexity immediately below the suture, with a slight concavity above and below the shoulder, which is thus rather conspicuous, almost lirate.

Of the two taken by the s.s. *Africana*, one (diam. 7.5 mm.) is typical, with shoulder and peripheral angulation; the other (diam. 11 mm.) shows a slight shoulder on 3rd whorl, but only a feeble rounded shoulder on 4th and 5th whorls, and the spiral striation is so weak as to be easily overlooked (unless the shell is dried).

The strength and regularity of the growth-lines is another variable feature. In one of the 3 shells from 36° 40' S., 21° 26' E., the growth-lines are very conspicuous, almost pliculate, on the tabulate zone below the suture, and also on the base where they form a cancellate sculpture with the spiral lirae at entrance to umbilicus. The East London shell from 300 fathoms is even more strongly sculptured. In the other shells from 36° 40' S., 21° 26' E., and other

localities the growth-lines are not conspicuous. The spiral striae/lirae on the base may also be evanescent.

The tabulate zone usually has a gentle slope downwards from the suture, but may be nearly horizontal. In the live example from off Cape St. Blaize, 90–100 fathoms, the zone is horizontal on the 3rd and 5th whorls, but on the 4th whorl it slopes slightly upwards from the suture to the angular shoulder.

Between the shoulder and the periphery the steepness of the slope also varies. Consequently there are 'high' and 'low' forms; the extremes in the present series are: 9×12 mm. (one from $36^{\circ} 40' S.$, $21^{\circ} 26' E.$) and 8×14 mm. (the live example mentioned above).

The suggestion by von Martens that the Australian *angulata* Angus = *prodicta* Fischer might be the same as the South African shell was not accepted by Thiele.

Solariella multistriata Thiele

Fig. 10 h

Solariella multistriata Thiele, 1925, p. 49, pl. 13 (1), fig. 18.

Protoconch nucleus plus 4 (5) whorls. Profile of whorls convex without any peripheral angulation. Fine spiral striae over whole whorl, and on base, becoming stronger at entrance to umbilicus. Growth-lines fine, not pliculate at umbilicus, which is wide and without any angulation. Being without any peripheral or umbilical angulation, the aperture is circular. Alt. 6, diam. 8.5 mm.

Jaws and radula as in *undata*.

$35^{\circ} 16' S.$, $22^{\circ} 26' E.$, 155 metres (Thiele).

$33^{\circ} 52' S.$, $25^{\circ} 50' E.$, 25 fathoms, 4 dead; $34^{\circ} 5' S.$, $25^{\circ} 55' E.$, 67 fathoms, 4 dead; off Cove Rock (East London), 22 fathoms, 5 dead (S. Afr. Mus. P.F. coll.).

Living: False Bay (U.C.T.).

Solariella agulhasensis Thiele

Fig. 10 g

Solariella agulhasensis Thiele, 1925, p. 51, pl. 13 (1), fig. 26.

The profile may have a slight shoulder high up near the suture or none at all; a slightly accentuated convexity at the periphery and a slight angularity at entrance to umbilicus; consequently the aperture is not quite circular, but slightly triangular. Growth-lines form pliculae at entrance to umbilicus. Alt. 5, diam. 7 mm.; diameter of Natal fragment 9.5 mm. 5.5×8 mm. (Thiele).

Fawn with faint darker undulate or zigzag flames.

$35^{\circ} 26' S.$, $20^{\circ} 56' E.$, no depth given (Thiele).

$34^{\circ} S.$, $25^{\circ} 44' E.$, 33 fathoms, 3 dead; off Nanquas Peak (eastern end of Algoa Bay), 63 fathoms, 1 dead; off Hood Point (East London), 49 fathoms, 4 dead; off Cape Natal (Durban), 85 fathoms, fragments (S. Afr. Mus. P.F. coll.).

Remarks. Having in view the variability found in other species I doubt whether this is distinct from *multistriata*.

Turton's *pulchella* 1932, with nucleus plus $3\frac{1}{2}$ whorls but diameter only 3.5 mm., may perhaps be synonymous.

Solariella laevisissima (von Martens)

Fig. 10 c

Trochus laevisissima von Martens, 1889, p. 54 (*sine* descr.).

Machaeroplax laevisissima von Martens, 1891, p. 257 (Latin diagnosis of shell), and pl. 25, fig. 15 (radula).

Solariella fuscomaculata Sowerby, 1892, p. 44, pl. 2, fig. 46; Bartsch, 1915, p. 161; Turton, 1932, p. 189, pl. 47, no. 1323.

Solariella beckeri Sowerby, 1901, p. 214, pl. 22, fig. 1.

Minolia (Nachaeroplax [sic]) congener Sowerby, 1903, p. 223, pl. 5, fig. 2; 1904, p. 19 (corrigendum); Peile, 1922, p. 17 (radula).

Minolia laevisissima von Martens, Sowerby, 1903, p. 231, pl. 5, fig. 2 [*sic*, typ. err. = 1].

Solariella laevisissima von Martens, 1903, p. 49, pl. 5, fig. 2.

Solariella nitens Thiele, 1925, p. 47, p. 13 (1), fig. 16.

Solariella rufanensis Turton, 1932, p. 189, pl. 47, no. 1324.

Protoconch nucleus plus 5–6 whorls. Profile of whorl convex, without any shoulder. Surface smooth and polished. No spiral sculpture (excessively minute, irregular and discontinuous striae may sometimes be seen). Growth-lines fine, not conspicuous except where they enter the umbilicus forming more or less well-marked radiating pliculae. Entrance to umbilicus rounded or more or less angular. Up to alt. 15, diam. 22 mm. (S. Afr. Mus.).

Buff, fawn, or slightly plumbeous, with darker wavy or zigzag or comma-like flames, interspersed with pale marks, often forming a 'necklace' at top and in middle of whorl; early whorls spotted with pink or brown; base with or without zigzag markings.

Jaws and radula as in *undata*, the latter with *c.* 30–35 rows.

33° 59' S., 17° 52' E., 91 metres (von Martens: *laevisissima*).

34° 33' S., 18° 21' E., 318 metres (Thiele: *nitens*).

Off Cape Infanta, 40 fathoms, and off Cape St. Blaize, 37 fathoms (Sowerby: *congener*).

Off Cape Natal (Durban), 55 fathoms (Sowerby: *congener*).

Port Elizabeth and Port Alfred (Sowerby, Bartsch, Turton: *fuscomaculata*, *beckeri*, *rufanensis*).

Cape Town (1 dead, *fuscomaculata*) (S. Afr. Mus.).

Off O'Neil Peak (Zululand), 2 dead; off Cape Natal, 54–55 fathoms, 2 dead (one of them fresh); off Rame Head (south of Port St. Johns), 43 fathoms, 1 dead; off Nanquas Peak (eastern end of Algoa Bay), 63 fathoms, 1 dead; off Cape St. Francis, 70 fathoms, 2 living; off Cape St. Blaize, 37 fathoms, 2 living, 39–44 fathoms, 5 dead, 105 fathoms, 2 dead, 125 fathoms, 2 dead; off Cape Infanta, 43 fathoms, 2 (one of them living); off Cape Point, 41 fathoms, 2 (one of them living), 50 fathoms, 1 dead, 166 fathoms, 1 dead,

210 fathoms, 3 dead; off Table Bay, 125 fathoms, 1 dead, 190 fathoms, 2 dead (S. Afr. Mus. P.F. coll.).

False Bay, living (U.C.T.). $30^{\circ} 42' S.$, $15^{\circ} 59' E.$, 201 metres, 1 living (s.s. *Africana*, per U.C.T.). $34^{\circ} 40' S.$, $22^{\circ} 0' E.$, 50 fathoms, 1 living (U.C.T.).

Type and cotype of *congener*, cotype of *beckeri* in S. Afr. Museum (A5257 and A3323 respectively).

Remarks. Although only comparatively few specimens (30) are available, there is no question that *congener* is synonymous. Sowerby himself was not consistent in labelling some of the P.F. specimens submitted to him, e.g. the largest specimen in the collection has very distinct umbilical pliculae but was labelled *laevissima*; and in his cotype of *congener* the pliculae become obsolete on the last part of the body-whorl. Specimens may have pliculae but not the angular entrance to the umbilicus, and vice versa.

High and low forms are not so marked as in *undata*, e.g. 10.5×15 mm. and 10×16 mm.

A juvenile from Cape Town, identified by Tomlin as *fuscocomaculata*, shows the *Segmentina*-like lines mentioned by Sowerby in his description of *beckeri*, and which are due to corrosion.

The Zululand and Natal shells are certainly conspecific with the *Africana* shell from the west coast.

Probably Turton's *kraussi*, *whitechurchi*, *rubromaculata*, *rubrolineata* and *rubrostrigata* are merely juveniles in various stages of beach-wear.

Peile (1922, p. 17) stated that a slide in the Gwatkin collection (British Museum) labelled *Minolia* (?) *congener* Sow., South Africa, showed a radula similar to that of *M*(?) *philippensis*, i.e. with an intermediate plate between the laterals and marginals (*vide infra*: *S. franciscana*). As this conflicts with the radulae here examined, it would seem that the animal from which Gwatkin extracted the radula was misidentified.

I have not seen Thiele's figure of the radula in Troschel's *Gebiss der Schnecken*.

The radulae of two large shells, diam. 20 mm., from off Cape St. Blaize, have a different central plate (fig. 10 c): the cusp is more broadly heart-shaped, with numerous small serrations; and the serrations on the 1st and 2nd lateral plates are also slightly more numerous. The shells have umbilical pliculae, but there are no features to separate them from other shells of *congener* and *laevissima*, whose radulae have been examined.

S. kempfi Powell 1951 has an oval heart-shaped central plate also with small serrations.

Solariella intermissa Thiele

Solariella intermissa Thiele, 1925, p. 49, pl. 13 (1), fig. 19.

Protoconch nucleus plus 5 (6) whorls. Profile strongly convex. First and 2nd whorls with 2 or 3 feeble spiral lirae, one of which is just traceable on 3rd whorl, but the outer layer of these whorls may have been abraded (showing

the nacreous layer) and probably the spiral lirae were originally more numerous and stronger (cf. the Fisheries Survey specimen); 4th and 5th whorls with numerous close-set fine spiral lirae; base with similar fine lirae and stronger ones within the widely open umbilicus. Growth-lines distinct on 2nd and 3rd whorls, almost pliculose, producing with the spiral lirae a clathrate sculpture, becoming finer and less distinct on later whorls. Aperture circular. Alt. 10, diam. 11 mm. (Thiele). Alt. 11, diam. ? 12 (S. Afr. Mus.).

White or pale cream, upper whorls iridescent.

35° 10' S., 23° 2' E., 500 metres, 1 broken (Thiele).

Off East London, 250-300 fathoms, 2 dead (S. Afr. Mus. A3604, P.F. coll.).

36° 48' S., 52° 08' E., 400 metres, 1 dead (Fisheries Survey R.S. *Africana II*).

Remarks. The *Pieter Faure* took 2 specimens, one of which was sent to Tomlin but remained unidentified and in his possession at the time of his death. The second specimen is broken but shows all the characters; the diameter cannot be accurately determined.

Thiele's specimen was in poor condition; he made no mention of axial pliculae on the apical whorls. No other elevated species with fine spiral lirae has been found in South Africa; the present specimen is therefore assigned to Thiele's species with fair confidence.

Solariella macleari n.sp.

Fig. 11 c

Protoconch nucleus plus 3 whorls. Profile convex. Axial retractive pliculae *c.* 25 on 2nd whorl, *c.* 32 on 3rd whorl, distinct on upper part of whorl, scarcely traceable at periphery and on upper part of base, but reappearing as short pleats on the lira surrounding the umbilicus. Faint spiral lirae one on 1st whorl forming a slight shoulder, with another very faint below it, 3 or 4 on 2nd whorl, 1 immediately below suture, the 2nd (continuation of the shoulder lira on 1st whorl) fairly distinct, the others feeble, on 3rd whorl 5 or 6 but very thin and faint; on base 2 or 3 also very faint. Umbilicus open, with 2 feeble spiral lirae within. Aperture subcircular, a slight angle at junction with columella. Alt. 2.5, diam. 2.75 mm. White, slightly iridescent.

Jaws and radula as in *undata*, the latter with *c.* 20 rows.

Cape Point N. 89° E., distant 36 miles, 700 fathoms, 10 living (S. Afr. Mus. A7417, P.F. coll.).

Remarks. Five of the specimens were sent to Tomlin and presumably are still in his collection (Cardiff Museum).

The retractive axial pliculae give a resemblance to *Cyclostrema semisculptum* von Martens 1903, but the shell is much higher proportionately to its breadth.

At first sight deceptively like the apical whorls of *gilchristi*, but careful comparison shows they are not the same. In *macleari* the protoconch is slightly smaller, and the diameter at 2½-3 whorls is less (*gilchristi*: 2½-3 whorls

diam. 3.5 mm.): the slight shoulder formed on the 1st and 2nd whorls by the 2nd lira disappears on the 3rd whorl in *macleari*, whereas in *gilchristi* it becomes stronger and is continued on later whorls.

It is possible that these shells are juveniles of *intermissa*, though the axial pliculae are much stronger than in the latter.

Until shells of intermediate size are forthcoming a separate name is introduced. The diameter of the East London *intermissa* at $2\frac{1}{2}$ -3 whorls is the same as in *macleari*.

Cape Maclear, one of the headlands at Cape Point; named after Sir Thomas Maclear, a former H.M. Astronomer at the Cape, and a Trustee of the South African Museum.

Solariella sp.

A specimen taken by U.C.T. (1960) in nearly the same locality, viz. $34^{\circ} 25' S.$, $17^{\circ} 36' E.$, 1,240 metres, is very similar to *macleari*.

4×4 mm. protoconch plus $3\frac{3}{4}$ whorls; axial pliculae 25 on both 2nd and 3rd whorls, and *c.* 21 on the last three-quarter whorl; on the latter the pliculae are not so sharply marked and one or two intermediaries (rather strong growth-lines) appear between each pair. First whorl corroded, a spiral lira forming a slight shoulder on the first quarter of 2nd whorl, but petering out on later part of whorl; on second half of 3rd whorl a slight granular thickening appears on each plicula at the shoulder, but the granules scarcely form a connected lira, and become evanescent on the last three-quarter whorl. Pliculae and growth-lines traceable over the periphery, the former continued on base, forming a series of granules on the lira surrounding the umbilicus, and continued within the umbilicus, where they are crossed by 4 or 5 fine spiral lirae. Bluish-white, iridescent.

The animal dark, but poorly preserved; only portions of the radula were obtained. The plates appear to resemble those in the radula of *undata*.

The shoulder granules are the most obvious distinction of the present specimen in contrast with *macleari* and the other South African species; nevertheless further specimens are desirable before proposing a specific name.

Solariella gilchristi n.sp.

Fig. 11 d

Protoconch nucleus, 0.4-0.5 mm., plus $4\frac{1}{2}$ whorls. Profile convex, slightly angular at shoulder and at periphery. Axial retractive pliculae *c.* 33 on 2nd whorl, *c.* 38-40 on 3rd, *c.* 45 on 4th whorl, distinct from suture to suture on 2nd and part of 3rd whorl, on 4th whorl represented by nodules at suture and at shoulder, and thereafter merging into the ordinary growth-lines. Axial pliculae reappearing in umbilicus. Spiral lirae 3 fine on 1st-4th whorls, the 1st near the suture, 2nd forming the shoulder, both nodulose where crossed by the axial pliculae, 3rd lira peripheral; fine intermediaries between 1st and 2nd lirae 1 on

2nd whorl, 2 on 3rd, 3 on 4th, and 6-7 on last half-whorl; also between 2nd and 3rd lirae 4 on 2nd and 3rd whorls, 5 or 6 on 4th, and 8-9 on last half-whorl. Upper part of base with 6-7 fine lirae, then smooth (with extremely faint striae in one of the specimens), but 7-8 lirae in the umbilicus, which is open and not sharply angular at entrance. Aperture circular, slightly angular at shoulder. Alt. 9, diam. 11 mm. Chalky white, iridescent internally.

Off Buffalo River (East London), 310 fathoms, 2 dead (S. Afr. Mus. A3605, P.F. coll.).

Remarks. A third specimen was sent to Tomlin, and is presumably still in his collection (National Museum, Cardiff). The strength of the intermediary lirae varies in the two specimens.

Named after Dr. J. D. F. Gilchrist, formerly Government Biologist in charge of the s.s. *Pieter Faure*.

Solariella turbynei n.sp.

Fig. 11 a

Protoconch nucleus plus $3\frac{3}{4}$ whorls. Profile convex, with a very slight shoulder. Axial pliculae obscure on 1st whorl, *c.* 30 on 2nd, *c.* 50 on 3rd, *c.* 55 on last three-quarter whorl; pliculae crossing the lirae and forming low feeble granules; continued across base and entering umbilicus. Spiral lirae obscure on 1st whorl, 4-5 on 2nd, 7 on 3rd with one or two fine intermediaries developing towards end of body-whorl; *c.* 11 on base and 3-4 within the widely open umbilicus. Aperture circular. Alt. 4, diam. 4.25 mm. Pale buff.

Cape Point, NE. $\frac{1}{2}$ N., distant 19 miles, 145 fathoms, 1 dead (S. Afr. Mus. A9276, P.F. coll.).

Remarks. Named after Capt. Turbyne, skipper of the *Pieter Faure*.

S. Kemp Powell 1951 from the Falkland Islands has many more spiral lirae.

Solariella franciscana n.sp.

Figs. 10 e, 11 b

Protoconch nucleus plus $5\frac{1}{2}$ whorls. Turreted, profile strongly convex, with tabulate shoulder. Sutures indented, somewhat canaliculate. Spiral lirae obscure on 1st whorl (a faint one at shoulder on last part of whorl), 3 on 2nd and 3rd whorls, the uppermost one forming the shoulder, a fine intermediary starting on 3rd whorl between suture and shoulder lira, increasing in strength and becoming the shoulder lira on 4th whorl, therefore 4 lirae on 4th whorl plus 1 intermediary between 2nd and 3rd, and 1 between 3rd and 4th lirae; on 5th whorl 6 lirae plus 2 fine intermediaries on the tabulate shoulder, and 1 between 6th lira and suture below, the 4th lira peripheral; 1st, 2nd, 4th and 6th lirae double or triple (divided by one or two fine striae); on base 5 spiral lirae, the uppermost one strongest and double, an intermediary between 3rd and 4th, and between 4th and 5th, 6 (7) lirae within the widely open umbilicus.

Growth-lines forming axial retractive pliculae in all the sulci, closer together and finer on the last whorl, but stronger in the umbilicus. Aperture circular. Alt. 12.5, diam. 13 mm.

Operculum with c. 11 spirals (inner ones not distinct), smooth. Uniform pale brown, operculum horny-amber. Radula with 40 rows, central and inner two lateral plates with very large cusps, finely serrulate on both margins on central plate, but only on outer margin on laterals, 3rd lateral plate broader than long, curved, with strong, serrulate cusp, 4th lateral plate arcuate, with serrulate margins, a transversely oblong intermediate plate with 4 (5) slender marginal plates attached to its outer end. In the normal position the marginal plates, which are about equal in length to the 3rd and 4th laterals and the intermediate plate together, overlie the 3rd and 4th laterals, leaving the central and two inner laterals exposed.

Off Cape St. Francis, 75 fathoms, 1 living (S. Afr. Mus. A3615, P.F. coll.).

Remarks. The radula is noticeably different from that of other South African species in the presence of the intermediate plate, and the very large cusps on the central and two inner lateral plates; viewed as a whole the middle portion of the radula bears a curious resemblance to the quinquelinear arrangement in *Sepia*.

A similar radula was figured by Peile (1922, p. 17, fig. 5a) for *Minolia* (?) *philippensis* (Watson).

The shell is comparable with the Californian *peramabilis* Carp. (see Oldroyd, 1927, p. 195, pl. 91, fig. 8, pl. 101, fig. 7), but has more lirae.

Solariella sp.

Fig. 11 e

Apices of a species of *Solariella* or *Minolia* have a larger protoconchal nucleus (0.5–0.6 mm.) than any other South African species, except possibly *gilchristi*; but they seem to belong to a less elevated species than the latter. Apart from the protoconch, they might perhaps be assigned to *franciscana* or to *M. adarticulata*, having a tabulate shoulder with axial pliculae, and fine striae between the spiral lirae (as far as preserved).

34° 5' S., 25° 55' E., 67 fathoms, 1; 34° 5' S., 25° 43' E., 52 fathoms, 2; off Cape St. Blaize, 125 fathoms 2; all fragmentary (S. Afr. Mus. P.F. coll.).

Solariella sp. Thiele

Solariella sp. Thiele, 1925, p. 51, pl. 13 (1), fig. 23.

34° 51' S. 19° 37' E. 80 metres.

Seems more like a *Gibbula*.

Stomatella articulata A. Adams

Fig. 12 b

Stomatella sulcifera (? non Lam.) Krauss, 1848, p. 93.

Stomatella articulata A. Adams, 1850, p. 30; 1854, p. 834, pl. 174, fig. 2.

Radula with *c.* 40 rows, central plate with cusp serrate on both margins, lateral plates with cusp serrated on outer margin, laterals passing gradually into the slender hamate marginals, which are also serrated on outer margin.

Port Elizabeth (Sowerby); Durban and Tongaat (S. Afr. Mus.). Natal, presumably living (Krauss). Living: Umgazana (Port St. Johns) (U.C.T.); Delagoa Bay (U.W.).

Remarks. The Tongaat specimens were identified many years ago by J. H. Ponsoy. As no material of other species is available, this identification is here accepted. The figures in the Thesaurus of *sulcifera*, *articulata*, *orbiculata*, etc. are useless for specific determination. The Durban and Delagoa Bay shells agree with those from Tongaat.

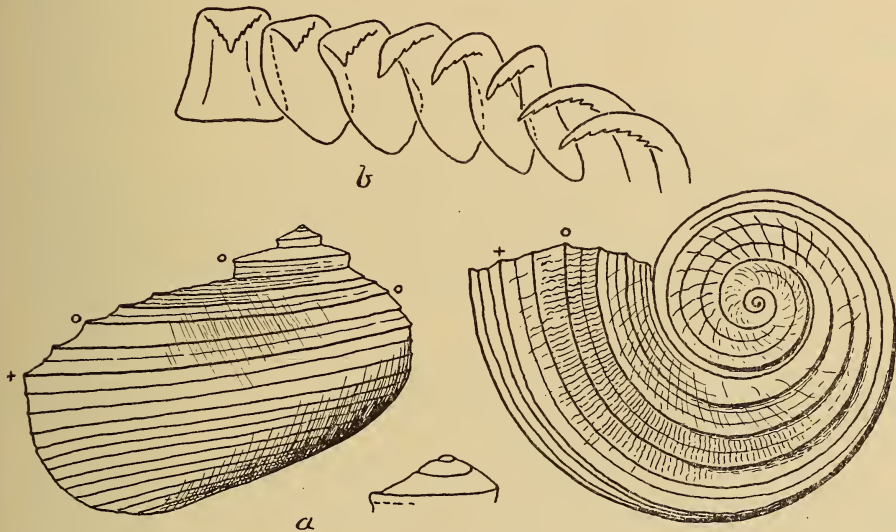


FIG. 12. *a*, *Stomatella* sp. (Sedgefield), two views, with apex further enlarged. + and o indicate corresponding lirae on the two figures. *b*, *S. articulata* A. Adams, radula plates.

It is unlikely that any species of *Stomatella* lives on the shores of Algoa Bay, and the reported occurrences of shells from that area (Sowerby, 1892, and Tomlin, 1923, p. 50) were probably due to human agency. Turton did not obtain any at Port Alfred.

Schwarz (1910, p. 115) recorded both *articulata* and *sulcifera* from Pleistocene deposits at Port Elizabeth.

† *Stomatella* sp.

Fig. 12 *a*

Specimens 6×8 mm., protoconch nucleus plus $3\frac{3}{4}$ whorls; 7×10 mm. with $4\frac{1}{4}$ whorls; 18×23 mm. with $5\frac{1}{4}$ whorls. Profile of 2nd and 3rd whorls tabulately angular, of 4th and 5th whorls convex, sloping. Sutures not indented;

in apical view suture between 2nd and 3rd whorls concealed by the prominent shoulder, but thereafter becoming fully visible. Two spiral lirae beginning on tabulate surface of 3rd whorl, with intermediaries developing on 4th whorl; on 4th and 5th whorls 5 main lirae, with intermediaries; on base 10-12 lirae, with an intermediary between some of the pairs.

Growth-lines forming pliculae, faintly visible on 2nd whorl, stronger on 3rd but never as strong as the spiral lirae, rather widely spaced; very faint and evanescent on 4th whorl, but replaced by close-set growth-lines visible between the lirae on upper surface and also on base.

Largest specimen seen: 18 × 23 mm., aperture 13 × 15 mm. (Sedgefield); smallest: 6 × 8 mm., aperture 4 × 5 mm. (Klein Brak River).

Dull biscuit-colour or pinkish-brown, with slightly darker patches below suture alternating with paler axial streaks (best seen in the Klein Brak River specimen), interior iridescent.

Fossil: Quaternary, Sedgefield near Knysna (A. R. H. Martin); Knysna raised beach (S. Afr. Mus.); Klein Brak River, Mossel Bay (S. Afr. Mus. coll. S. H. Haughton).

Remarks. Differs from the specimens referred to *articulata* by the tabulate 2nd and 3rd whorls, in consequence of which the suture in apical view is not visible throughout; and by the much feebler axial pliculae which nowhere form with the spiral lirae a cancellate sculpture. At first sight the shell appears to be only spirally lirate.

S. sulcifera Lam. and *mariei* Crosse are the only species available for comparison, and therefore no specific name is attached to these specimens. Probably, however, they are the same species as the fossils from Port Elizabeth which Schwarz identified as *sulfifera*.

S. mariei Cross (2 specimens in S. Afr. Mus. ex coll. Ross-Frames), from New Caledonia, is similar in having a lirate, not a cancellate, sculpture; but the apical whorls are much more conical, with a concave profile, and no tabulate shoulder on 2nd and 3rd whorls.

Clanculus puniceus (Phil.)

Fig. 14 a

Monodonta puniceus Philippi, 1846, p. 100.

Trochus puniceus Krauss, 1848, p. 100 (part: the larger specimens).

Clanculus puniceus Sowerby, 1892, p. 45 (probably var. of *pharaonis*).

Protoconch nucleus plus 5-6 whorls. In fully grown shells the last whorl near the aperture dips down below the periphery of preceding whorl. The granules in the series next below the suture very little larger than those in the other rows, ovoid, and continuing as granules up to the outer lip.

High and low forms (fully grown): 18 × 19 mm., 17 × 22 mm., and 16 × 21 mm.

No jaws. Radula with c. 55-60 rows, central plate with cusp serrate on both margins, lateral plates with cusp serrate on outer margin, laterals passing

gradually into the slender, apically hooked marginals which are also serrate on outer margin; serrations not numerous on any of the cusps.

Uniform reddish, paler on base; a midwhorl and a peripheral series of black spots, each spot covering 1 or 2 (3) granules; 2 or sometimes 3 series on base; the midwhorl series on the *fourth* row of granules below the suture; outer lip in fully grown examples with black spots.

Dead: Isipingo, Durban, Tongaat (S. Afr. Mus.).

Living: Natal (Krauss); Durban (S. Afr. Mus. coll. K. H. B.; also U.C.T.); Delagoa Bay (S. Afr. Mus. coll. K. H. B.; also U.W.); Bazarute Island (S. Afr. Mus.); Quelimane (von Martens).

Clanculus atricatena Tomlin

Trochus puniceus Krauss, 1848, p. 100 (part: the 2 half-grown specimens, *cum* descr.).

Clanculus kraussi (non Phil.) Sowerby, 1897, p. 19.

Clanculus atricatena Tomlin, 1921 *a*, p. 216; 1931 *a*, p. 418.

Protoconch nucleus plus 5 whorls. Last whorl at aperture in fully grown shells dipping down below periphery of preceding whorl. The series of granules next below the suture distinctly larger than the other granules, axially oblong, on last half whorl of 5th whorl gradually evanescent and replaced by oblique pliculae (growth-lines). All the granules over the whole whorl smaller than in *puniceus*, the interstices thus more conspicuously obliquely striate or plicate with growth-lines. The granules on the inner lirae on base often more oblong and tessellated than in *puniceus*.

Fully grown: 14 × 17 mm. and 12 × 15 mm.; Tomlin: 12.5 × 17 mm.

Brownish or greyish, below the suture a more or less distinct series of darker squarish patches alternating with paler marks, and extending downwards to the periphery, sometimes over the periphery as narrow oblique streaks on to the pale base; a midwhorl and a peripheral series of black spots, each spot covering 1-3 granules, 2 series on base; the midwhorl series on the *third* row of granules below the suture; outer lip in fully-grown shells with black spots.

Natal (Krauss). Isipingo and Tongaat (S. Afr. Mus.). Off Itongazi River (between Port Shepstone and Port Edward), 25 fathoms, 2 dead (S. Afr. Mus. P.F. coll.).

Remarks. The distinct but rather subtle differences between this species and *puniceus* were first noticed by Krauss, and later utilized by Tomlin to characterize shells which had been recorded from South Africa as the West African *kraussi* Phil. Tomlin, however, did not contrast his species with *puniceus*; in particular he did not mention the petering-out of the subsutural oblong granules on the last half-whorl and their replacement by oblique pliculae.

One of the Itongazi and 2 of the Isipingo specimens have the midwhorl series of black spots on the fourth row of granules (as in *puniceus*) owing to the interpolation on the 3rd-4th whorls of an intermediary series of granules.

Future investigation must decide whether the differential characters are really specific (or possibly sexual ?). Both forms seem to occur together.

Clanculus miniatus (Anton)

Fig. 15 a, b

Trochus miniatus Anton, 1839, p. 58; Krauss, 1848, p. 99.*Clanculus carinatus* A. Adams, 1851, p. 162.*Clanculus depressus* (non Phil.) von Martens, 1874, p. 129.*Clanculus alfredensis* Bartsch, 1915, p. 150, pl. 23, figs. 10-12; Turton, 1932, pp. 178, 179 (not pl. 42, no. 1258 juv. = *waltonae*).*Clanculus elevatus* Turton, 1932, p. 179, pl. 42, no. 1260.*Clanculus trochiformis* Turton, 1932, p. 179, pl. 43, no. 1261.*Clanculus becki* Turton, 1932, p. 179, pl. 43, no. 1262.*Clanculus eucosmia* Turton, 1932, p. 179, pl. 43, no. 1263.*Clanculus kowiensis* Turton, 1932, p. 180, pl. 43, no. 1267.

Protoconch nucleus plus 5-6 whorls. Smallest example seen: diam. 3.5 mm., no umbilicus, only a shallow groove in the columella. At diam. 5 mm. the groove is more prominent, but still no umbilicus is formed (cf. Turton's fig. 1267 of a 5 mm. shell). At diam. 8 mm. the groove is deeper and leads to a definite umbilical pit (cf. Bartsch's figs. 10 and 12 of 8.7 mm. *alfredensis*).

At diam. 10 mm. the tooth at anterior end of columella is beginning to develop; at 11-12 mm. there is a definite tooth, and 3-4 small denticles on the adjacent margin of outer lip; at 13 mm. there are about 6 denticles on outer lip, continued as plicae on inner surface; at 15-16 mm. the denticles are continuous around the whole of the inner margin of lip. When the denticles begin to form, the body whorl begins to drop away from the periphery of the preceding whorl (as in adult *puniceus* and *atricatena*). In one example the aperture underrides the preceding whorl to such an extent that the top of the outer lip is attached to the base midway between the margin of umbilicus and the peripheral keel.

Although the early whorls are more or less angular at the periphery, the peripheral keel does not become prominent until the 4th whorl. The prominence of the midwhorl series of granules is subject to considerable variation, but is less conspicuous on the later whorls, and the granules may sometimes be no larger than the granules above and below it.

Up to: alt. 16, diam. 17 mm.

No jaws. Radula with *c.* 50 rows, as in *puniceus*.

Table Bay and 'an der ganzen Südspitze' [presumably meaning Cape Agulhas, or ? around to Natal] (Krauss); False Bay (von Martens).

False Bay, Hermanus, Still Bay, Mossel Bay, Port Elizabeth, Kowie (S. Afr. Mus.). Living: False Bay; Knysna; Mossel Bay (U.C.T.).

Mossel Bay, 20 fathoms, 1; Algoa Bay, 20 fathoms, 1; False Bay, 9-11 fathoms, 2 living (S. Afr. Mus. P.F. coll.).

Delagoa Bay (U.W., not seen by me).

Remarks. In spite of Krauss's record, the South African Museum has no examples from Table Bay, and the species probably does not occur there.

Unless Krauss's words include Natal, there is a big gap between Port Alfred and Delagoa Bay without any records.

In my opinion neither Bartsch's *alfredensis*, nor any of Turton's 'species' (except *exquisita*) can be accepted as species. It is not surprising that Turton, believing the shell he figured on pl. 42, no. 1258, was the juvenile of *miniatus*, should regard *kowiensis* (pl. 43, no. 1267) as a distinct species; fig. 1258 shows a canaliculate suture, which, in conjunction with the pliculate growth-lines, clearly indicates a juvenile *waltonae*.

Sowerby did not mention the number of lirae on the base of *laceyi* (1889a, p. 11), but Turton (1932, p. 179 under *elevatus*) said the British Museum specimen (? Type) had 6 lirae; nevertheless I suspect that *laceyi* is another synonym of *miniatus*.

Clanculus waltonae Sow.

Clanculus waltonae Sowerby, 1892, p. 45, pl. 2, fig. 45; Bartsch, 1915, p. 151; Turton, 1932, p. 180.
Clanculus miniatus (non Anton) juv. Turton, 1932, p. 178, pl. 42, no. 1258.

On 1st postnuclear whorl 2 low spiral lirae, on 2nd 3 lirae, feebly granulose, especially the subsutural lira, on 3rd whorl 4 granulose lirae, the 2nd lira weakest, the 3rd and 4th stronger than 1st, on 4th whorl 5 lirae, the 4th and 5th peripheral, the 5th present on preceding whorl but obscured by suture, and showing only on exposed part of body whorl. On base 7 lirae, the innermost one bordering the umbilicus, but not undulate or denticulate, the outer 2 lirae feebly granulose. Well-marked retractively oblique pliculate growth-lines over whole whorl, including sutural border and base, and making the lirae sharply crispate, but less so on base. Suture canaliculate, the groove formed partly by the whorl above and partly by the whorl below. Protoconch nucleus plus 4 whorls: 6 × 7 mm. (S. Afr. Mus.); 5½ whorls 8.5 × 11 mm. (Sowerby).

No jaws. Radula with *c.* 50 rows, as in *puniceus*, but central plate much broader than in *puniceus* or *miniatus*.

Port Elizabeth (Sowerby); Port Alfred (Bartsch, Turton). Off Cove Rock (East London), 22 fathoms, 1 dead but fresh; 33° 3' S., 27° 57' E. (East London), 32 fathoms, 1 dead but fresh (S. Afr. Mus. P.F. coll.).

Living: False Bay (34° 19' S., 18° 30' E.) 52 metres (U.C.T.).

Remarks. Turton's figure corresponds with the present P.F. specimen (identified by Tomlin), but shows an intermediary lira between the 2nd and 3rd lirae. Sometimes an intermediary between 3rd and 4th lirae on 4th whorl (or last part of it).

Sowerby's description gave 9 basal lirae on a larger shell than the present one. In unworn specimens the pliculate growth-lines are very sharp.

In having a very broad central plate in the radula this species resembles *Monodonta australis* more than *Clanculus puniceus*.

Clanculus mixtus Smith

Clanculus mixtus Smith, 1903, p. 389, pl. 15, fig. 7; Turton, 1932, p. 180.

Protoconch nucleus plus 4 whorls (Smith: total 5-6 whorls). Profile convex, last whorl not angular (even more convex than in half-grown non-

carinate *miniatus*). On 1st whorl 3 spiral lirae, on 2nd 3 lirae with 2 intermediaries developing on later part, on 3rd whorl 3 main lirae and 2-3 intermediaries, on 4th whorl 6 or 7 with 2-3 intermediaries; owing to the convexity of the profile the peripheral lira is not always clearly distinguishable from the first basal lira; on base 6-8 lirae. All the lirae granulose, but not crispate, those on base usually less strongly granulose. Interstices with fine oblique striations (growth-lines; finer than in *waltonae*). Suture canaliculate. In adult the last part of the last whorl drops down below the periphery of preceding whorl, exposing a series of granules previously concealed in the suture. Umbilicus deep, sometimes with marginal undulations or denticles. In adult coumella with a denticle above and a denticle below; outer lip denticulate. and plicate within. 11×12.5 mm. (Smith); 8×10 mm. (S. Afr. Mus.)

Dull pinkish-brown, with a subsutural series of darker patches alternating with paler patches; base pale with pinkish spots on the granules.

Port Elizabeth (Smith); Port Alfred (Turton; also S. Afr. Mus.); Xora (Elliotdale Division).

Remarks. A similarly coloured but smaller species than *miniatus* and differing from half-grown non-carinate examples of the latter by the canaliculate suture and rounded peripheral profile. Differs from *waltonae* in the more convex profile, non-crispate granules, and finer non-plicate growth-lines.

The features mentioned by Smith for differentiating this species from *waltonae*, viz. last whorl descending in front, thickened and lirate outer lip, and umbilical denticles, are merely adult characters.

The granules may vary in size. In one of 4 Pondoland (= Port Alfred, coll. Dr. Becker) specimens in the South African Museum the granules on the 1st lira below the suture on 3rd and 4th whorls are noticeably enlarged (cf. *atricatena*) and continue thus to the outer lip. In another shell this series of granules is obsolete on the last quarter-whorl after an injury, the other series being continued but with smaller granules.

Another of these 4 shells has the suture canaliculate on 2nd and 3rd whorls, but on the 4th (especially later half) the uppermost series of granules has moved close to the suture line, obliterating the usual striated space between them; this part of the shell thus looks very like *miniatus*; also there are 10 series of granules, all (excepting one intermediary) subequal in size; and on the base 9 series.

Priotrochus obscurus (Wood)

Figs. 13 (left), 14 d

Trochus obscurus Wood, Krauss, 1848, p. 98.

In very young shells the diameter slightly exceeds the altitude, e.g. alt. 3.5, diam. 4 mm.; at about diam. 10 mm. the altitude and diameter are subequal, thereafter the altitude exceeds the diameter, e.g. 17×15 , 19×17 , and 28×18 mm.

Grey or buff, with darker greenish-grey axial flames extending from suture to periphery, and often on to base.

Jaws present, but thin and weak. Radula with *c.* 45-50 rows, lateral plates increasing slightly in size outwards, marginal plates hamate, cusps on all plates non-serrate.

Natal (Krauss, Sowerby). Living: Durban (S. Afr. Mus. juv.); Delagoa Bay (S. Afr. Mus. coll. K. H. B., also U.W.); Inhambane (U.C.T.); Mozambique Island (U.W.).

Remarks. It is probable that the specimens recorded as *obscurus* from a raised beach at Klein Brak River really belong to the following species.

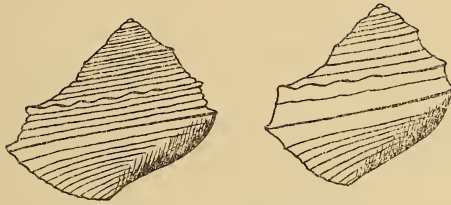


FIG. 13. Juveniles of *Priotrochus obscurus* (Wood) left, and *P. alexandri* Tomlin right; 3.5×4 mm. and 3.5×3.5 mm. respectively.

Priotrochus alexandri Tomlin

Fig. 13 (right)

Priotrochus obscurus (non Wood) Smith in Rogers, 1906 *b*, p. 293.

Priotrochus alexandri Tomlin, 1926 *a*, p. 295, pl. 16, fig. 8.

Not quite so elevated in adult as *obscurus*, but altitude slightly greater than diameter, although in the Type the reverse is the case.

Protoconch nucleus plus 5 whorls. Second and following whorls angularly shouldered; 2nd whorl with 2 spiral lirae, 3rd with 3, the middle lira forming a midwhorl shoulder, a thin intermediary lira between the middle and lower lirae which may or may not persist on to later whorls, middle lira with faint indications of nodules; on 4th and 5th whorls middle lira with 11-12 conspicuous nodules, complanate, but extending upwards towards the suture making the now inconspicuous 1st lira feebly nodulose; in apical view the 3rd lira is undulate, corresponding with the shoulder nodules. A 4th lira forms the periphery but is more or less absorbed in the suture, and does not become wholly visible until the last whorl; in apical view it also is slightly undulate. On base 7 (8) lirae well separated by concave sulci. Retractive growth-lines very distinct, on 4th and 5th whorls often almost pliculose, especially on base. Alt. 3.5, diam. 3.5 mm., 4.5×5 , 13×12 , 18.5×17 mm. Tomlin: 16.5×18 mm.

The largest Sedgfield shell shows faint traces of darker axial flames, passing over the periphery on to base, where they are best seen.

Fossil: Quaternary: Sedgefield near Knysna (A. R. H. Martin); raised beach deposit, Knysna lagoon. Klein Brak River, Mossel Bay (Smith in Rogers; also S. Afr. Mus.).

Algoa Bay (Tomlin).

Remarks. The finding of this species in Quaternary deposits raises the question whether the specimens found at Algoa Bay had been washed out of similar deposits. Compare the case of *Cerithium rufonodulosum* Smith (Barnard, Part III, p. 131).

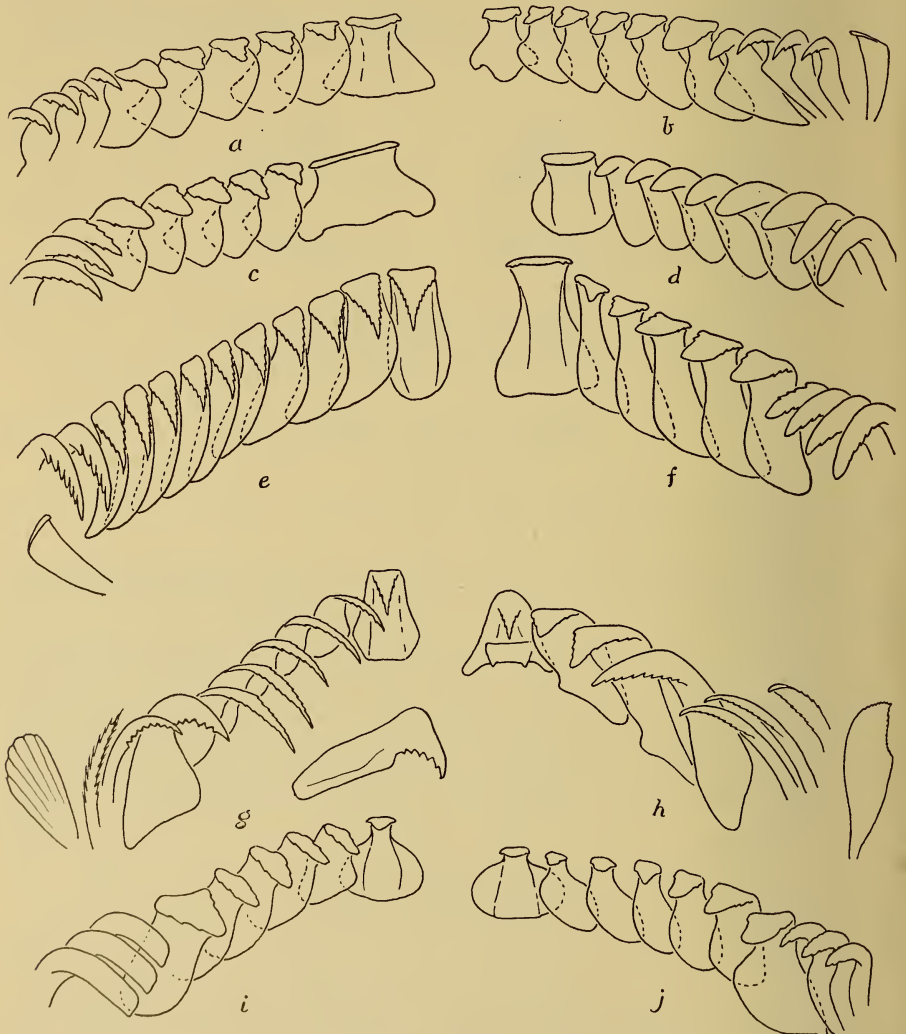


FIG. 14. Radula plates of: a, *Clanculus puniceus* (Phil.); b, *Trochus nigropunctatus* Rve.; c, *Monodonta australis* Lam.; d, *Priotrochus obscurus* (Wood); e, *Calliostoma eucosmia* Bartsch; f, *Oxysteles sinensis* (Gmelin); g, *Calliostoma perfragile* Sow., with 1st marginal plate in a different position; h, *Calliotropis granolirata* (Sow.); i, *Cantharidus fultoni* (Sow.); j, *Gibbula rosea* (Gmelin).

Monodonta australis Lam.

Fig. 14 c

Monodonta australis Lamarck, 1822, p. 35; Krauss, 1848, p. 100; Day & Morgans, 1956, p. 306 (listed).

Up to alt. 32, diam. 29 mm. Dark greenish spots alternating with pale intervals on the lirae. The dark spots on successive lirae may correspond in an axial direction, but the general effect is spiral necklaces around the whorls, not axial flames which characterize *Priotrochus obscurus*.

Radula with 55-60 rows, central plate oblique, broader than long, lateral plates serrate on both margins at base of the cusps, marginal plates uncinete, serrate on both margins.

Living: Point, Durban (Krauss); Durban (S. Afr. Mus. P.F. coll., also K. H. B., and U.C.T.); Umhlali (Natal) (U.C.T.); Scottburgh (Natal) (S. Afr. Mus. coll. K. H. B.).

Remarks. Krauss (1848, p. 100) also recorded *M. labio* (Linn.) (as *Trochus (Labio) labio*) from Natal, but there does not appear to be any later record.

The central plate of the radula is slightly oblique, so that the lateral plates on the two sides are not quite at the same level (cf. some *Fissurellids*).

Trochus nigropunctatus Rve.

Fig. 14 b

Trochus nigropunctatus Rve., Macnae & Kalk, 1958, pp. 45, 117 and 127 (listed).

Jaws present but rather thin and weak. Radula with c. 60-65 rows, central plate hourglass-shaped, rounded-lobate posteriorly, 5 lateral plates, increasing in size outwards, 1st marginal plate broadly expanded inwards, following marginals uncinete, serrate on outer margins, outermost plate elongate-triangular, distal edge truncate, scarcely turned over.

Living: Port St. Johns (S. Afr. Mus. coll. F. Talbot); Inyoni Rocks, Umtwalumi, and Port Edward (Natal) (U.C.T.); Delagoa Bay (S. Afr. Mus. coll. K. H. B., also U.W.).

Sowerby's record (1892) from Port Elizabeth is not acceptable, certainly not for living shells.

Remarks. The presence of jaws and the shape of the central plate of the radula suggest that this species would be better placed in some other genus.

Trochus (Cardinalia) virgatus Gmelin

Trochus (Cardinalia) virgatus Gmelin, Smith, 1903, p. 388. Durban (coll. Burnup).

Even though credited to Burnup's collecting, I doubt whether this is a true inhabitant of South African waters. It was not found at Durban by U.C.T., nor at Delagoa Bay by myself or U.W.

Calliostoma eucozmia BartschFigs. 14 *e*, 15 *f**Trochus ornatus* (non Lam.) Krauss, 1848, p. 98.*Trochus bicingulatus* (non Lam.) Krauss, 1852, p. 33.*Calliostoma ornatum* (non Lam.) Sowerby, 1892, p. 42; von Martens, 1903, p. 47; Thiele, 1925, p. 54; Turton, 1932, p. 193, pl. 49, no. 1340.*Calliostoma bicingulatum* (non Lam.) Sowerby, 1892, p. 42; Turton, 1932, p. 192 (? the juv. pl. 49, no. 1339.)*Calliostoma euglyptum* (non A. Adams) Sowerby, 1892, p. 42.*Calliostoma euglyptum* = *ornatum* Smith, 1903, p. 401.*Calliostoma eucozmia* Bartsch, 1915, p. 161, pl. 25, figs. 1-3; Turton, 1932, p. 193.*Calliostoma ornata* var. *similis* Turton, 1932, p. 193, pl. 49, no. 1341.*Calliostoma albolineata* Turton, 1932, p. 193, pl. 49, no. 1342.*Calliostoma convexa* Turton, 1932, p. 193, pl. 49, no. 1345.

Protoconch nucleus plus 8 whorls; profile (of whole shell) nearly straight, sometimes slightly concave, more or less slightly indented at sutures, periphery more or less angulate. Spiral granulate lirae 3 on 1st whorl, 3-4 on 2nd, 4-5 on 3rd, 5-6 on 4th, increasing to 15-18 on last whorl (Bartsch's Type has a worn apex: his '1st' whorl probably equals the 3rd; in any case 23 lirae on last whorl seems too many: see his fig. 2); lirae subequal in strength, but a broader lira at the periphery, often duplicated. On 2nd and 3rd whorls the granules connected by axial pliculae. On base *c.* 20 lirae, more or less granulate. Umbilicus closed from about shell diam. 3 mm.

The above described sculpture may be regarded as typical, but there is considerable variation in the number of lirae and the development of the granules, from about the 3rd whorl onwards.

One lira in midwhorl and another between it and suture below may be slightly or conspicuously enlarged, hence the records of '*bicingulatum*' (see also Pilsbry's description of *ornatum*). Coalescence may reduce the number of lirae to 6. The granules, which are typically circular or slightly transversely oval, may become axially oval or oblong; they may be greatly increased in number, and then form closely-set narrow pliculae. A few selected variations and transitions are illustrated.

Shells with more or less typical sculpture up to alt. 23, diam. 22 mm.; also 21 × 22 mm. Shells with lirae reduced and close-set pliculae (fig. 15*f*, fourth from left) alt. 24, diam. 26 mm.

Fulvous or orange-brown, with diffused or more or less sharply defined darker patches, some of the lirae articulated, especially the peripheral one (or two); base speckled with articulate lirae; sutures between early whorls (2nd to 4th or 5th) often lilac or violaceous. Beach specimens may become completely pink or violaceous.

Jaws present, with intercalated platelets. Radula with *c.* 110 rows, central plate longer than broad, slightly expanded at sides, 9 lateral plates, cusps lengthening on outer plates as they approach the marginal plates, 1st marginal stout, strongly serrate, outermost marginal oblong, the truncate distal margin slightly turned over.

False Bay to East London (S. Afr. Mus.).

Living: False Bay, 9 fathoms; off East London, 25 and 85 fathoms (S. Afr. Mus. P.F. coll.); False Bay, Mossel Bay, Port Elizabeth (U.C.T.).

Remarks. Bartsch said it was 'remarkable that this large species should have been overlooked so long'. It has not been 'overlooked', but, as Bartsch said, recorded from South Africa as *ornatum* and *bicingulatum*. Apparently Krauss, Sowerby (3rd), Smith, von Martens, and Thiele were satisfied as to the identity of the South African shells. But Bartsch considered there were differences, though unfortunately he did not state them. Tomlin accepted *eucosmia*, and I follow him, especially as the modern description is accompanied by a clear figure. Turton seems to have included as many 'names' as possible, and added 2 n.spp. and one n.var. Another case of a common and variable species being described several times.

Sowerby (1892) recorded several varieties from Port Elizabeth, fortunately recognizing them as varieties. With only a comparatively limited amount of material in the South African Museum, including a good series from Still Bay (coll. Muir), the variation in the lirae and the granulate ornamentation is very striking.

There are 'high' and 'low' forms, though the contrast is not strongly marked. The profile may be straight or slightly concave, and the periphery may be sharply angulate or almost rounded; but I have not seen any shell which could be regarded as transitional to *multiliratum* in which the periphery of the body-whorl is completely rounded.

I doubt whether *layardi*, with its suprasutural pliculae, and peculiar intermittent nodules on the suprasutural lira, can be brought into the synonymy.

Calliostoma africanum Bartsch

Calliostoma africanum Bartsch, 1915, p. 162, pl. 24, figs. 2, 4, 6.

An elevated form. Protoconch nucleus plus 7 whorls; profile straight, more (young shells) or less (older shells) sharply angulate at periphery. Spiral granulate lirae 2 on 1st whorl, 3 at end, 3 on 2nd and 3rd, 4-5 on 4th, 7 on 5th, 8-9 on 6th, and 10-12 on 7th whorl; on 2nd and 3rd whorls granules on the lirae connected by axial pliculae. On base 12-15 smooth or feebly granulate lirae. Alt. 17.5, diam. 15 mm.

Isolated brown or orange-brown or fulvous squarish blotches on a pale ground on lower half of whorl, sometimes extending a little above midway. Living examples show only faint traces of the isolated patches, indicating that these become accentuated in beach shells; the latter often become pink.

Jaws with intercalated platelets. Radula with c. 80 rows, central plate as in *eucosmia*, only 5 lateral plates, with very long slender hamate cusps, 1st marginal plate stout, outermost marginal obovate, with incompletely separated plates (cf. *perfragile*).

Port Alfred (Bartsch, Turton; also S. Afr. Mus.). Port St. Johns, littoral, 1 living (S. Afr. Mus. coll. F. Talbot); Umhlali (Natal), littoral, living (Mrs. Connolly, 1962).

Off Nanquas Peak (eastern end of Algoa Bay), 63 fathoms, 2 dead; off Great Fish Point, 22 fathoms, 2 living; off East London, 85 fathoms, 1 dead; off Itongazi River (Natal), 25 fathoms, 1 living; off Umkomaas (Natal), 40 fathoms, 2 juv. dead; off Cape Vidal (Zululand), 80–100 fathoms, 1 juv. dead (S. Afr. Mus. P.F. coll.).

Remarks. Turton was inclined to regard this as only another variety of *eucosmia*; and at first I was also inclined to regard it as a colour variety. Apart from colour pattern, the altitude exceeds the diameter more distinctly than in 'high' shells of *eucosmia*.

Examination of the radula, however, disclosed a clear anatomical difference between the two species: the present species having only 5 lateral plates.

The distribution, according to the records, extends much farther north-east and less far west than *eucosmia*.

Calliostoma burnupi Smith

Calliostoma burnupi Smith, 1899b, p. 250, pl. 5, fig. 11 (= xi) (not fig. 2 as given by Smith, 1903, p. 389).

Five worn specimens from the original locality, Durban (Ross-Frames coll.), do not add much to Smith's description.

Smith's text says 8 whorls; the figure shows only 6 or possibly 7 including the protoconch. None of the present specimens has (or would have had when unworn) more than 7. Spiral lirae (? on 1st whorl) 4 on 2nd and 3rd whorls, the 3rd lira peripheral and strong, the 4th weaker, on 4th whorl 5 lirae, on 5th and 6th whorls 6; the lowest (suprasutural) less prominent than the peripheral one above it. On base 8–10 feebly granulose lirae. Umbilicus closed. Shell thickwalled.

Calliostoma multiliratum (Sow.)

Fig. 15 g

Ziziphinus multiliratus Sowerby, 1875, p. 127, pl. 24, figs. 10, 11.
Calliostoma liratum (*laps. cal.*) Sowerby, 1900, p. 6.

Two specimens, the larger 11 × 10 mm., from Pondoland, presented by Dr. H. Becker, labelled 'liratum'; presumably therefore part of the material reported on by Sowerby in 1900.

Whorls convex, body-whorl rounded, without peripheral angulation. Spiral lirae 3 on 2nd and 3rd whorls, 4 on 4th, 5 main lirae on 5th whorl with intermediaries; the uppermost lira on last whorl strongly granulate, concealing in side view the suture, which is thus canaliculate. In the larger specimen many of the granules on the uppermost lira and the upper peripheral

lira on body-whorl are distinctly transversely oval and some of them enlarged and nodulose; but not so prominently as in typical *layardi*.

Further material is obviously desirable.

Judging by the respective figures, it might be useful to compare *multiliratum* and *crossleyae* Smith 1910.

Calliostoma layardi Sow.

Fig. 15 c

Calliostoma layardi Sowerby, 1897, p. 18, pl. 8, figs. 10, 11.

Protoconch nucleus plus 7 whorls. Profile (of whole shell) straight, indented at sutures. Spiral lirae 2 on 1st whorl, 3 on 2nd-4th whorls, granulate at intersections with retractive axial pliculae of which there are (1st whorl

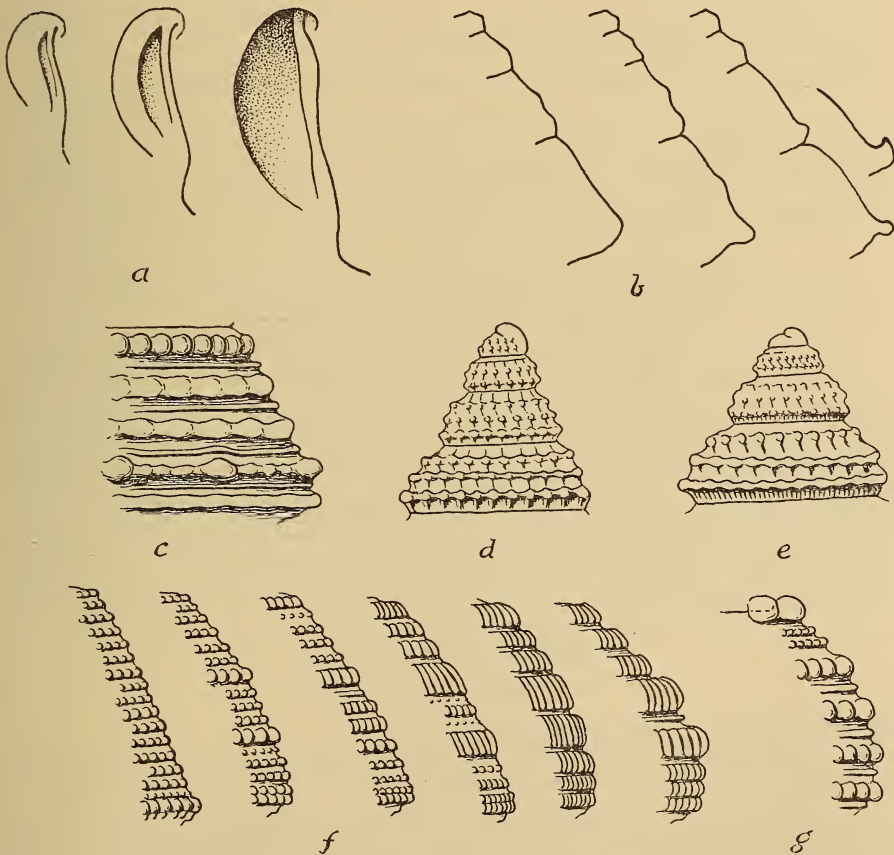


FIG. 15. a, *Clanculus miniatus* (Anton), stages in growth of the umbilicus: diam. of shell 3.5 mm., 5 mm. (cf. Turton's figure of *kowiensis*), and 8 mm. (cf. Bartsch's figure of *alfredensis*). b, Profiles to show variation of *C. miniatus-carinatus*. c, *Calliostoma layardi* Sow., portion of whorl. d, *C. iridescens* Sow., apex. e, *C. perfragile* Sow., apex. f, *C. eucosmia* Bartsch, profiles to show variation, typical form on left. g, *C. multiliratum* (Sow.) profile.

worn) *c.* 20 on 2nd whorl, *c.* 22 on 3rd; on 4th whorl lirae granulate but pliculae obsolete; on 5th whorl 4 granulate lirae, on 6th whorl 5, on 7th whorl 7 (8); the uppermost lira and lowermost lira stronger and more strongly granulate than the others, on the latter about every 4th or 5th granule is enlarged and nodulose, so that in apical view the periphery is slightly undulate; the lowest lira, which with the nodulose lira produces the bicingulate periphery, is only seen on the body-whorl; there is often a fine intermediary between the two lirae. Base with 10–12 lirae, the inner 3 or 4 broader and slightly nodulose. Sutures channelled. The axial pliculae, which on 2nd and 3rd whorls extend from suture to suture, on later whorls may be traceable between the lirae but are usually well marked between the lower lira and the suture, at least as far as the 5th whorl, though inconspicuous on 6th and 7th whorls. Up to 15 × 16 mm.

Uniform buff (P.F. specimen). Beach specimens fulvous with slightly darker marks, chiefly on the peripheral lirae.

Jaws with intercalated platelets. Radula (only one available) with *c.* 70 rows, central plate laterally expanded but longer than broad, 5 lateral plates, with long slender hamate cusps, 1st marginal plate strong, outermost marginal rather broadly obovate, composed of 4 or 5 incompletely separated plates.

Pondoland (Sowerby: also S. Afr. Mus.: 4 coll. Dr. H. Becker).

Off Itongazi River (Natal) 25 fathoms, 1 living (S. Afr. Mus. P.F. coll.).

Remarks. Distinguished by the channelled sutures, the bicingulate body-whorl, and the intermittently nodulose suprasutural lira.

The exact locality on the Pondoland coast is uncertain. Layard (Curator, S. Afr. Museum, 1855–72) did not visit the eastern districts of the Colony (Layard, *Birds of South Africa*, 1867, p. vii), but one of his correspondents was Mrs. F. W. Barber (loc. cit., p. vi) of 'Tharfield' near Port Alfred, well known as a keen naturalist (I. & R. Mitford-Barberton, *The Bowkers of Tharfield*, Oxford, 1952, p. 33). In all probability, therefore, the original locality was 'The Kowie' = Port Alfred, where later Dr. Becker collected. Turton, however, did not obtain any specimens. The living example indicates that its true habitat is farther towards Natal.

Calliostoma perfragile Sow.

Figs. 14 *g*, 15 *e*

Calliostoma perfragile Sowerby, 1903, p. 222, pl. 5, fig. 3.

Calliostoma ornatum (non Lam.) part, von Martens, 1903, p. 47.

Calliostoma capense Thiele, 1925, p. 54, pl. 13 (1), fig. 33.

Shell thin-walled. Protoconch nucleus plus 8 whorls; profile (of whole shell) straight or slightly concave, indented at sutures. Spiral lirae 2 on 1st whorl, 3 on 2nd, the uppermost one feeble at start, 3 on 3rd whorl with an intermediate between 1st and 2nd lirae towards end of whorl, 4 on 4th whorl, with an intermediary between 2nd and 3rd lirae at end of whorl, 5–6 on 5th whorl and 7–8 on 6th and 7th whorls, with intermediaries developing so that

on 8th whorl there are *c.* 13 lirae of more or less equal strength; on early whorls all lirae granulate, but on 5th whorl the granules are evanescent on the lower 3 (4) lirae, and on succeeding whorls the lower 3 or 4 (5) lirae are quite smooth. Lowermost lira (peripheral) moderately sharp. Base smooth, usually with 3 spiral striae near outer margin, and 5 in centre; but faint lirae may be present in the intervening space, and in the largest specimen the base is covered from margin to umbilicus with *c.* 25 lirae. Umbilicus closed in the smallest specimen (8 mm.). Sutures channelled on early whorls, less so on later whorls. 18×18.5 mm. (figured Type); up to 24.5×22.5 mm.

Cream or pale biscuit-colour, slightly iridescent externally; carinal lira articulated with faint brown marks in some shells (e.g. the Type).

Jaws with intercalated platelets. Radula with *c.* 120 rows, central plate laterally expanded but longer than broad, 5 lateral plates with long serrulate cusps, 1st marginal plate very large, 2nd and 3rd or 4th not so strong, serrate on concave margin, following marginals slender, serrate on both margins, outermost marginal oval-oblong, appearing to consist of 5-6 incompletely separated plates.

Off Cape Point and west coast of Cape Peninsula, 154-166 fathoms (Sowerby); also several living and dead specimens from same area, 91-190 fathoms; $34^{\circ} 26' S.$, $25^{\circ} 42' E.$, 124 fathoms, 1 dead but fresh (S. Afr. Mus. P.F. coll.).

$34^{\circ} 33' S.$, $18^{\circ} 21' E.$, 318 metres (von Martens, Thiele).

$30^{\circ} 42' S.$, $15^{\circ} 59' E.$, 201 metres (s.s. *Africana* per U.C.T.).

Figured Type in the South African Museum (A5275).

Remarks. Thiele said his *capense* seemed to be somewhat similar to *perfragile*; it is undoubtedly synonymous. Perhaps Sowerby's figure does not express very clearly the most noticeable feature of the species: the granulate lirae on upper half of whorl contrasted with the smooth lirae on lower half. Thiele's figure is correct, but both kinds of lirae on the last whorl seem to be unduly accentuated. Usually there is not such a sharp distinction, the granules disappearing more gradually. The *Pieter Faure* specimen from south of Cape Recife, and the *Valdivia* specimen, show that the species is found along the southern slope of the Agulhas Bank, extending round Cape Point to the west coast.

Calliostoma iridescens Sow.

Fig. 15 *d*

Calliostoma iridescens Sowerby, 1903, p. 223, pl. 5, fig. 4.

Shell rather thin. Protoconch nucleus plus 7-8 whorls; profile (of whole shell) straight but slightly concave, scarcely indented at sutures, angulate at periphery. Spiral lirae 2 on 1st whorl, 3 on 2nd-4th, granulate at intersections with retractive axial pliculae, of which there are 14-15 on 1st whorl, *c.* 18 on 2nd; *c.* 22 on 3rd, *c.* 24 on 4th whorl, producing a clathrate appearance; intermediaries start developing on later part of 4th whorl, on 5th whorl 3

granulate lirae and 2 intermediaries, on 6th whorl 6 lirae, on 7th 9 lirae, only the upper 2 granulate, the others smooth; on 8th whorl 11-13 lirae, the upper 1 or 2 feebly granulate (moniliform), the peripheral lira sharp. Base with 15-17 lirae, the inner 2 or 3 feebly nodulose, the innermost one entering the open umbilicus. Sutures slightly channelled on early whorls, scarcely so on later whorls. 16 × 17 mm.

Buff or fawn, with fulvous marks around the periphery, iridescent externally.

Off Cape Natal (Durban), 55 fathoms (Sowerby).

Off Umhloti River (Natal), 100 fathoms, 2 dead; off Cape Natal, 54 fathoms, 1 living, 1 dead (S. Afr. Mus. P.F. coll.).

Figured Type in the South African Museum (A5294).

Remarks. Sowerby in his description placed this species in the subgenus *Astele* Swainson 1855, but on his label for the Umhloti River specimens he used the synonym *Eutrochus* A. Adams 1863.

In this species, as in *perfragile*, there is a contrast between the granulate upper lirae and the smooth lower lirae on the later whorls; but here the granules are suppressed earlier and to a greater degree, remaining only on the two upper lirae and even on these more or less evanescent on the last whorl.

The Type is fresh, but was not taken alive. In the only specimen (half-grown) taken alive, the animal was completely decomposed and had been washed out, only the operculum remaining wedged obliquely in the aperture.

Calliotropis granolirata (Sow.)

Fig. 14 h

Calliostoma (*Lischkeia*) *granoliratum* Sowerby, 1903, p. 222, pl. 5, fig. 7.

Solariella infundibulum (non Watson) von Martens, 1903, p. 48, pl. 4, fig. 22.

Calliotropis granolirata Thiele, 1925, p. 48.

Shell not thin-walled. Protoconch nucleus plus 6 whorls. First whorl with *c.* 20 axial slightly retractive pliculae, 2nd whorl with *c.* 22-24, and 2 spiral lirae forming nodules at intersections; on 3rd whorl lirae become evanescent as continuous lirae, only the 2 series of nodules, *c.* 16 in number, remaining, with a 3rd series more or less occluded in the suture; on 4th and 5th whorls *c.* 16 nodules, on 6th *c.* 20; the 3rd (peripheral) series with *c.* 36-40 nodules on last whorl. On base 4 nodulose spiral lirae. Growth-lines on later whorls distinct. Umbilicus axially striate, but closed except for a short narrow chink. 12 × 13 mm. (figured Type); 13 × 12 mm. (cotype).

Cream or pale biscuit-colour, not iridescent externally.

Jaws thin, without intercalated platelets. Radula with *c.* 40-45 rows, central plate triangular, extending in front of the finely serrulate cusp, 3 stout lateral plates with finely serrulate cusps, *c.* 16 marginal plates, the inner ones slender, the outermost one broader, outer distal margin slightly concave, both margins distally finely serrulate.

Animal with large frontal veil, fimbriate at margin, continued into the epipodium which has 4 or more cirri on each side. Eyes shortly-stalked, black.

Off Cape Point, and west coast of Cape Peninsula, 250–630 fathoms, numerous examples living and dead (S. Afr. Mus. P.F. coll.).

35° 33' S., 18° 20' E., 2,750 metres (von Martens); 35° 19' S., 20° 12' E., 126 metres (Thiele).

Figured Type (A5296) and a cotype in the South African Museum.

Remarks. The locality 'Cape Point' given by Sowerby was correct, but not 'False Bay . . . 45 fathoms'. Smith (1906a, i, p. 54) quoted the correct locality but the wrong depth.

Thiele recorded a specimen from 126 metres, which led him to regard the species as not necessarily a deep-water species. His locality is also considerably east of any of the other records.

Thiele examined the animal of a *Pieter Faure* specimen obtained from Sowerby, and on the basis of the radula (not figured) transferred the species to *Calliotropis*.

Comparable in appearance with *Solariella valida* Dautzenberg & Fischer (1906, p. 57, pl. 3, figs. 22–27) from off Cape Verde, 1,311 metres.

It may be noted that *infundibulum* Watson (probably to be included also in *Calliotropis*) was taken by the *Challenger* off Marion Island in 1,375 fathoms, and also off Bermuda in 1,075 fathoms.

Calliotropis metallica (W.-M. & A.)

Solariella metallica Wood-Mason & Alcock, 1891, p. 444, fig. 12 a, b.

Margarita (*Turricula*) *aethiopica* von Martens, 1901, p. 24.

Basilissa aethiopica von Martens, 1903, p. 125, pl. 4, fig. 20; Thiele, 1903, p. 162, pl. 8 (3), fig. 40 (radula).

Solariellopsis metallica Schepman, 1908, p. 59.

Calliotropis aethiopica Thiele, 1925, p. 43.

Calliotropis metallica (W.-M. & A.), Barnard, 1963b, p. 440, fig. 8 a.

Shell thin-walled. Protoconch nucleus plus 7 whorls. First to 3rd whorls each with *c.* 20 slightly retractive axial pliculae, 4th with *c.* 25, thereafter pliculae evanescent (as pliculae extending across whorl) but their position marked by the tubercles; 2nd and following whorls with 2 thin spiral lirae, feeble at start, later forming conical tubercles at intersections with the axial pliculae; on each whorl *c.* 20–25 tubercles, the number increasing sometimes to *c.* 30 on back of 7th whorl, the upper and lower series of tubercles not always quite agreeing in number; a 3rd (subperipheral) lira, smooth or only feebly tuberculose, occluded in the suture until the later part of 6th whorl.

Base with 4 spiral lirae, the outer 3 thin and smooth, or feebly granulose-tuberculose, the inner one bordering the umbilicus nodulose. Growth-lines distinct on base, especially where they enter the widely open umbilicus, in which they form axial pliculae. 21 × 19 mm. Von Martens (*aethiopica*): 32.5 × 31 mm.

Cream or pale biscuit-colour, more or less iridescent externally.

Animal with jaws and radula as in *granolirata*. See also Thiele's figure of the radula of *aethiopica*.

Off Cape Point and west coast of Cape Peninsula, 560–930 fathoms, numerous examples living and dead (S. Afr. Mus. P.F. coll.).

33° 26' S., 16° 33' E., 1,300 fathoms, 1 living, 1 dead; 34° 36' S., 19° 00' E., 1,500 fathoms, 1 living (S. Afr. Mus. F. H. Talbot coll.).

Distribution. Gulf of Manaar, 738 metres (Wood-Mason & Alcock); East Indies, 918–2,029 metres (Schepman); East Africa, between Cape Guardafui and Aden, 1,840 metres (von Martens: *aethiopica*).

Remarks. A thinner-shelled and deeper-water species than *granolirata*.

The discovery of this species by the *Pieter Faure* off Cape Point forms a notable extension of the hitherto known distribution. I have no hesitation about the identity of the Cape specimens with *aethiopica*, which was considered by Schepman as a variety, and by Thiele as a subspecies of *metallica*; and I see no reason to maintain a varietal or subspecific name.

The East African shells are the largest shells. Differences in the number of basal lirae is due to terminology: in the above description the 3rd, i.e. subperipheral, lira is the same as the outermost basal lira of the other authors.

Calliotropis persculpta (Sow.)

Solariella persculpta Sowerby, 1903, p. 223, pl. 5, fig. 8.

Calliotropis persculpta Thiele, 1925, p. 48 (probably allied to *Calliotropis granolirata*).

Protoconch nucleus plus 5 whorls; profile of 1st whorl slightly angulate, of 2nd–5th whorls biangulate, the lower angle carinate. First part of 1st whorl smooth, followed by *c.* 15 axial pliculae, 2nd whorl with *c.* 20 pliculae, each with 2 tiny sharp points, towards end of whorl the pliculae not continuous from suture to suture; on 3rd whorl the points in the upper series number *c.* 18–20, but they tend to increase and become pliculose in the lower series; on 4th whorl the points in the upper series become feeble, but those in the lower (carinal) series form very numerous closely imbricate pliculae; on 5th whorl the upper series of points usually quite obsolete, only a blunt spiral angulation remaining. Growth-lines distinct on 4th and 5th whorls, especially near the carinal pliculae. A third, more or less granulate (sutural) lira at bottom of whorl is partially occluded in the suture; on body-whorl visible below the carina, running from top of aperture and forming the outermost basal lira.

In addition to the lira just mentioned, 4 more or less granulate spiral lirae, the innermost one entering the open umbilicus. 6 × 8 mm. (figured Type); 8 × 9 mm. (Sowerby's measurements in text); up to 6.5 × 8, 6.5 × 9, and 6.5 × 10 mm. (topotypes in S. Afr. Mus.).

Cream or pale biscuit-colour, not externally iridescent.

Radula as in *granolirata*, but the outermost marginal plate is not different from the preceding marginals.

Off Cape Natal (Durban), 440 fathoms, 2 (Sowerby); topotypes from bottom-sample of same haul, 8 (S. Afr. Mus. A9249, P.F. coll.).

Figured Type in the South African Museum (A5251).

Remarks. Sowerby's description is masterly. His four basal lirae included the lira called the sutural lira in the above description, but he added that the entrance to the umbilicus is nodulosely lirate (innermost lira in the above description); there is thus no discrepancy in the two descriptions.

The Type in the South African Museum corresponds in altitude with the line indicating the natural size in Sowerby's figure, and is accompanied by his autograph label; the measurements given in his description seem to have been taken from the second specimen submitted to him (? where is this specimen).

From one of the 8 topotypes I have extracted the radula. Although it has not the peculiar outermost marginal plate found in the radulae of *granolirata* and *metallica*, it is certainly not that of a *Solariella*. Thiele's suggestion that *persculpta* was allied to *granolirata* is thus confirmed.

The East Indies '*Solariellopsis*' *limbifera* Schepman 1908 is closely allied, and probably also belongs to *Calliotropis*.

Calliotropis chenoderma n.sp.

Fig. 16 c

Protoconch nucleus plus 3 whorls. Axial pliculae *c.* 18 on 1st whorl, increasing to *c.* 26 on last whorl; distinct on 1st and 2nd whorls, but less so on 3rd. One spiral lira beginning on 1st whorl, 2 on 2nd, becoming by interpolation 6 on 3rd whorl; intersections with the pliculae forming sharp upstanding points. Base with 4 (Cape St. Blaize) or 5 (Cape Morgan) spiral lirae. Umbilicus sharply demarcated, 2 lirae within. Columella partially reflexed over umbilicus, expanded at lower end. Aperture subcircular. In the Cape St. Blaize shell a short intermediary between umbilical margin and 1st internal lira (inserted in the figure, but not actually visible in the position in which the shell is figured). Alt. 3.5, diam. *c.* 3 mm. (outer lip broken); alt. 2.5, diam. 2.75 mm.

Buff, nacreous within (Cape St. Blaize); white, iridescent (Cape Morgan).

Cape St. Blaize N. \times E., distant 73 miles, 125 fathoms, 1 dead; off Cape Morgan, 47 fathoms, 1 dead but fresh (S. Afr. Mus. A9296 and A9297 respectively, P.F. coll.).

Remarks. The Cape St. Blaize shell is very fragile, and the outer layer is very liable to flake off, exposing the nacreous internal layer. The smaller Cape Morgan shell is fresh and unworn, but does not show the 'goose-skin' sculpture so conspicuously.

Without the radula the generic position is doubtful; included in *Calliotropis* provisionally.

Seguenzia sykesi Schepman

Fig. 16 b

Seguenzia sykesi Schepman, 1909, p. 180, pl. 12, fig. 6.

Protoconch nucleus plus 5 whorls. Each whorl with a blunt lira forming an angular midwhorl shoulder; a 2nd lira, peripheral, only shows on the body-whorl; below the suture a narrow fillet; in addition extremely fine spiral striae between the lirae. Fine close-set axial pliculae on 1st–3rd whorls between suture and shoulder; becoming inconspicuous on 4th and 5th whorls, but more or less traceable on the subsutural fillet. Base with 7 lirae, the outermost one and the one bordering the umbilicus stronger than the others. Umbilicus open. Columella with strong pleat near lower end forming a knob projecting into aperture. Approximately 3×3 mm. White.

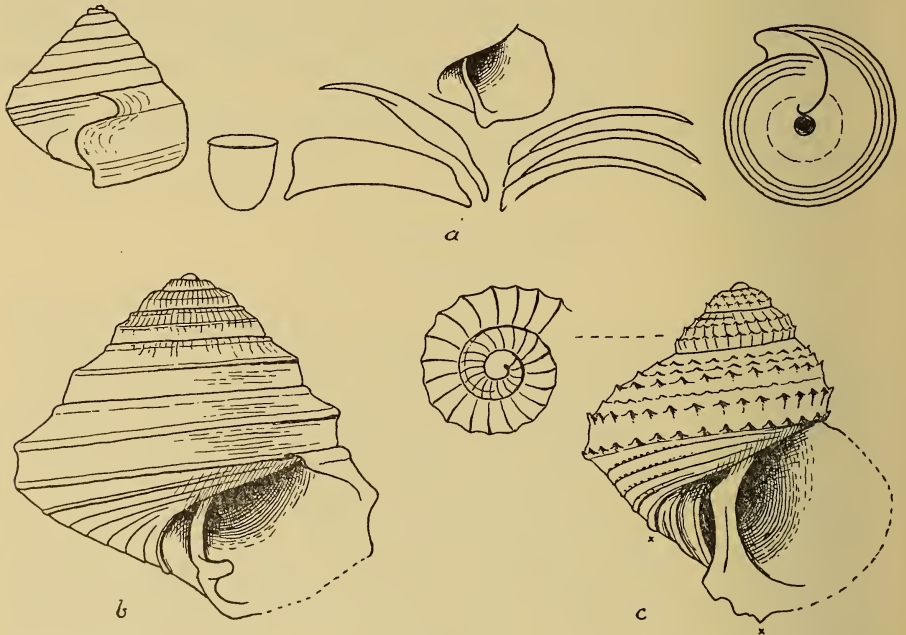


FIG. 16. a, *Seguenzia simplex* n. sp., lateral and basal views, aperture, and radula plates. b, *S. sykesi* Schepman. c, *Calliotropis chenoderma* n. sp., with apical view further enlarged.

Natal (exact locality ?), 1 dead (S. Afr. Mus. A9298, P.F. coll.).

Distribution. East Indies, 1,570 metres.

Remarks. This specimen, though broken, shows all the essential features, and agrees so well with Schepman's description and figure that the identification cannot be avoided.

S. orientalis Thiele (1925, p. 46, pl. 13 (1), fig. 12) from $1^{\circ} 40' S.$, $41^{\circ} 47' E.$, 693 metres, is a very similar species, which may perhaps become a synonym when fresh material is available. The occurrence off the East African coast helps to bridge the gap between the East Indies and Natal.

Seguenzia simplex n.sp.

Fig. 16 a

Protoconch nucleus plus 4 whorls. Profile straight, with a very slight angulation forming the lower border of the sinus (where the growth-lines change direction from concave to convex). A peripheral lira shows only on the last whorl. First and 2nd whorls with fine axial pliculae; 3rd and 4th with extremely fine spiral striae. Base with 3-4 spiral lirae on upper part, followed by one which forms a slight angulation marking the slope leading into the narrow and deep umbilicus, 5-6 striae on the slope. Growth-lines extremely fine. Aperture subcircular, slightly produced at anterior end; columella nearly straight, without any pleat or knob. 3×3 mm.

White, iridescent.

Radula with *c.* 35 rows, central plate oblong, with overturned cutting-edge but not distinctly serrate, 1 transversely elongate lateral plate, 1st marginal hastate, and 3 slender hamate marginals.

Cape Point N. 89° E., distant 36 miles, 700 fathoms, 8 specimens (S. Afr. Mus. A7421, P.F. coll.).

Remarks. Not a typical *Seguenzia* because it lacks the columellar pleat, but *siberutensis* Thiele (1925, p. 47, pl. 13 (1), figs. 13, 14), from the East Indies, 750 metres, and Zanzibar Channel, 463 metres, agrees in this respect. In other respects also there is close similarity between the two species, except that *siberutensis* is distinctly higher than wide.

Eight specimens were taken. Four of these were sent to Tomlin, but not described; presumably they remain in his collection (National Museum, Cardiff). Of the four in the South African Museum 2 contained animals, and 1 is a juvenile with protoconch plus 2 whorls.

One radula was obtained. It is very delicate but agrees with that figured by Schepman (1909, p. 178, pl. 15, fig. 12); there appear to be 3 outer marginal plates in each row.

Clarke (1961, p. 350) has assigned to *S. elegans* Jeffreys a specimen (not figured) taken by the *Vema* at station $18^{\circ} 23' S.$, $8^{\circ} 11' E.$, in 2,262 fathoms (about 400 miles west of Walvis Bay). Also *S. louiseae* n.sp. from the same locality and from 2,507 fathoms about 1,450 miles south-west of Cape Town; *carinata* Jeffreys from 1,703 fathoms about 400 miles north-west of Cape Town; *eritima* Verrill from station 18, 2,262 fathoms; *antarctica* Thiele from station 18, and from 2,670 fathoms about 300 miles south-west of Cape Town.

Clarke refers to the difficulty of precisely defining the species owing to considerable variability.

Guttula blanda n.sp.

Fig. 17

Protoconch nucleus plus $3\frac{3}{4}$ whorls. Surface quite smooth, without any trace of spiral lirae, and the growth-lines, though distinct on the last whorl,

are not pliculose. Very fine spiral striae at entrance to umbilicus, which is almost closed by the reflexed columella. The latter angular at anterior end, but margin of lip broken. Alt. 3.5, diam. 4 mm. White, iridescent. Operculum very thin.

Jaws reticulate. Radula with *c.* 22 rows, central plate with 2 projecting points on posterior margin, and a small recurved cusp flanked by a minute denticle, only 1 lateral plate, oblong, anterior margin convex, no recurved cusp or denticle, number of marginal plates few (not more than 10), 1st strong, hamate, with 1 minute denticle on outer edge, 2-3 on inner edge, the others falcate, becoming more slender.



FIG. 17. *Guttula blanda* n. sp., with radula plates.

Cape Point N. 89° E., distant 36 miles, 700 fathoms, 1 living (S. Afr. Mus. A7424, P.F. coll.).

Remarks. The radula indicates that this specimen can be included in the genus *Guttula* Schepman 1908 (Thiele, 1929, p. 48). *G. sibogae* Schepman, from the East Indies, 835 metres, has the altitude greater than the diameter, but in other respects the two species are very similar.

The radula corresponds with that of *sibogae* (Schepman, 1908, pl. 9, fig. 11) except that the 1st marginal plate is larger than the following ones; possibly these plates had been displaced in Schepman's mount of the radula.

Euchelus natalensis Smith

Euchelus natalensis Smith, 1906a, p. 55, pl. 8, fig. 5; Turton, 1932, p. 193.

Euchelus gemmula Turton, 1932, p. 194, pl. 49, no. 1347.

Immature shells are perforate, adults imperforate. Up to 4.5 × 4.5 mm. Durban (Smith); Port Alfred (Bartsch, Turton); Still Bay (S. Afr. Mus. coll. Muir.).

Off Illovo River (Natal), 27-30 fathoms, 1 juv.; off Cape Morgan, 77 fathoms, 2 juv.; off Cove Rock (East London), 80-100 fathoms, 1 juv.; all dead (S. Afr. Mus. P.F. coll.).

Remarks. Allowing for its being a worn shell with broken aperture, the shell figured by Turton for his *gemma* does not seem very different from Smith's figure. Adult shells have up to *c.* 30 axial pliculae, which towards the end of the last whorl are somewhat crowded together.

Oxystele sinensis (Gmelin)

Fig. 14 f

Trochus merula Lamarck, 1822, p. 16; Krauss, 1848, p. 95.*Trochus meruloides* Krauss, 1848, p. 95.*Oxystele sinensis* Gmelin, Tomlin, 1931 a, p. 418; Turton, 1932, p. 181, pl. 43, no. 1269 (juv.).*Oxystele inflata* Turton, 1932, p. 181, pl. 43, no. 1271.

Protoconch nucleus plus 8-9 whorls. Spiral lirae 4 on 2nd whorl (3 sulci), increasing to 7-8 at end of 3rd whorl, and continuing on 4th, 5th and 6th whorls, at first wider but later narrower than the sulci, later evanescent and eventually obsolete, though traceable on interior of aperture. On base of 3rd and 4th whorls 9-11 lirae, of 5th and 6th whorls 12-15, less prominent than the lirae on upper part of whorl; after the 6th whorl base becomes smooth, lirae and sulci traceable only by coloration.

Apices of large shells always corroded. Growth-lines fine and close-set on early whorls, on later whorls interspersed irregularly with coarser ones. Umbilicus on shells of 3-4 whorls (diam. 3-6 mm.) open or partially closed, thereafter completely closed.

Up to alt. 46 (apex worn), diam. 51 mm. High and low forms, e.g.: alt. 42, diam. 52 mm., 46 × 49, 46 × 51, 24 × 25, 24 × 26, 24 × 28, 16 × 22, and 18 × 24 mm.

In juveniles the pale lirae conspicuous against the dark sulci, usually 3-5 white axial streaks, either of uniform width or more usually wedge-shaped, expanding towards the periphery, but not extending below it, sometimes reduced to small subsutural spots, or absent; later (from 5th or 6th whorl) becoming uniform dull blackish with a violaceous tinge. Base in juveniles paler with dark sulci, later almost as dark as upper part of whorl, but with a roseate tinge, becoming lighter towards centre, a bright crimson or roseate band on the columellar glaze, columella white; aperture internally white, nacreous, outer lip with black margin.

Radula with c. 55-65 rows, central plate narrow, lateral plates sloping backwards oblique to axis, cusps serrate on both margins, marginal plates hamate, 1st serrate on both margins, following plates only on outer margin.

Fossil: Pleistocene; Algoa Bay (Johnson, 1904).

False Bay to Algoa Bay and Port Alfred (*auct. et S. Afr. Mus.*). Sebastian Bay, low tide (*S. Afr. Mus. P.F. coll.*).

Remarks. Turton's *inflata* is merely a casual variation; a slight 'berm' is visible in some of the Still Bay series in the South African Museum, especially in one shell 14 × 19 mm.

The largest specimens I have seen were collected by myself on the beach at Cape Hangklip.

Oxystele tigrina (Chemn.)*Trochus tigrinus* Chemn., Krauss, 1848, p. 96.*Monodonta tigrinus* Odhner, 1923, p. 5.*Oxystele tigrinus* Turton, 1932, p. 181, and var. *vascoi*, p. 182.*Oxystele sagittifera* Lam. var. *perdix* (Koch), Turton, 1932, p. 182, pl. 44, no. 1280.

Protoconch nucleus plus 8-9 whorls. Spiral lirae on 2nd whorl (?) (no very young unworn shells seen); on 3rd and following whorls 4 or 5, rounded, broader than in *sinensis*, subequal to the sulci, usually traceable on 8th and 9th whorls if not corroded. On base 8-10 lirae, usually evanescent after 6th or 7th whorl, obsolete on largest shells. Growth-lines fine and close-set. Umbilicus partially closed on shells of diam. 5 mm., and completely closed on those of diam. 9 mm.

Up to alt. 41, diam. 43 mm. Turton mentions one of 47 mm. Altitude and diameter often subequal, but the former may exceed the latter: 35×32 and 36×35 mm.

Blackish with a more or less violaceous or roseate tinge, the lirae darker than the sulci, and usually with series of white dots; base dark, with or without white dots on the lirae, no red mark or tinge, columella white; aperture internally white, nacreous, outer lip with black margin.

Radula as in *sinensis*.

Fossil: Pleistocene; Algoa Bay.

Saldanha Bay, Table Bay, and False Bay to Natal (*auc. et S. Afr. Mus.*). Saldanha Bay and Still Bay (U.C.T.).

Remarks. A more elevated species than *sinensis*, and more constant in its proportional measurements.

At Still Bay Dr. Muir obtained only one juvenile under diam. 9 mm., although juveniles of *sinensis* were very plentiful.

Krauss said he collected it also at Cape Verde Islands, but possibly his specimens were *punctulifera*, which also has white dots.

Turton's '*sagittifera* var. *perdix*' is too large for a *sagittifera* (= *variegata*), and has blunt lirae on the body-whorl; thus it seems to be obviously a *tigrina*.

Oxystele variegata (Anton)

Trochus variegatus Anton, 1839, p. 57.

Trochus impervius Menke, 1843, p. 18; Krauss, 1848, p. 96, and var. *variegatus*.

Trochus indecorus Philippi, 1844, p. 143, pl. 24, fig. 5.

Oxystele sagittifera Lam., Smith, 1903, p. 389 (note); Bartsch, 1915, p. 152 (descr. juv.); Turton, 1932, p. 182, nos. 1276-1279 (not 1280 = *tigrina*).

Oxystele impervius Menke, Schwarz, 1910, p. 115; Barnard, 1913, p. 80, fig. (feeding track).

Oxystele sagittifera Lam., var. *rufanensis* Turton, 1932, p. 183, pl. 44, no. 1281.

Oxystele tabularis Krss., var. *pulchra* Turton, 1932, p. 183, pl. 44, no. 1282.

Protoconch nucleus plus 6 whorls (Krauss: 8). Spiral lirae on 1st whorl traceable but all present specimens worn; on 2nd whorl 5-6, on 3rd 6-7, thereafter evanescent, only the intervening striae remaining, but these may often be numerous (when traceable) on 4th whorl. Base of 3rd whorl with 7-8 lirae, evanescent on 4th whorl though sometimes faint striae may be traceable. Umbilicus usually closed at shell diam. 5-6 mm.

Up to alt. 34, diam. 24 mm. High and low forms, e.g. alt. 11, diam. 12 mm. and 9×12 ; 16×18 ; 13×18 ; 23×23 and 19×22 mm.

Colour and pattern very variable; but whether the whorls are speckled,

spotted, blotched, or streaked with protractive flames or zigzags, one feature is constant and is seen in the smallest juveniles, viz.: a series of squarish spots below the suture, darker than the ground-colour, and alternating with paler or white spots; these dark spots are often extended as flames or zigzags; sometimes the whole shell is very dark or blackish, in which case the subsutural spots remain more or less visible, or faint traces of streaks are visible on base.

These black shells are distinguishable from *sinensis* by the absence of the crimson flash on the base, or if juveniles by the absence of the white wedge-shaped streaks and the less conspicuous spiral liration.

Radula as in *sinensis*.

Fossil: Pleistocene, Port Elizabeth (Schwarz).

Table Bay and False Bay to Port St. Johns (*auct. et S. Afr. Mus.*). Lüderitzbucht, Port Nolloth and Saldanha Bay (U.C.T.). Mozambique Island (U.W.).

Remarks. Bartsch in describing a 2.5 mm. diam. juvenile said there were 17 spiral threads 'between the periphery and summit' on 3rd whorl; and also 12 on the base. Both these numbers seem too high if 'threads' mean raised lirae, not impressed striae.

The colour pattern described by Bartsch is not characteristic of all juveniles, but is only one of several patterns; in fact it is far less common than some of the other patterns.

In the present material there are only 3 specimens which show this particular pattern of alternating red and green axial stripes of approximately equal width, all of them larger than Bartsch's juvenile: 2 from False Bay (S. Afr. Mus. coll. Lightfoot, also U.C.T.), and one from Mozambique Island (U.W.).

The latter locality is unexpected. Krauss gave Natal as a locality, but there appears to be no later record of this species from north of Port Alfred and the Peddie coast; Lightfoot did not obtain it at East London.

Oxysteles tabularis (Krss.)

Trochus tabularis Krauss, 1848, p. 97, pl. 5, fig. 30.

Oxysteles tabularis Turton, 1932, p. 183; Day & Morgans, 1956, p. 306 (listed); Macnae & Kalk, 1958, p. 127 (listed).

In the present material no examples with unworn early whorls. Apart from the possibility of a specific difference in the early whorls, there seems to be no *conchological* difference between this species and *variegata*. The larger shells are more consistently of the 'high' form: alt. 12, diam. 13-14 mm., though 'low' forms occur in the younger shells: 8 × 10 and 4 × 5 mm. Removal of the outer layer of the shell-wall discloses no difference in the spiral liration of the nacreous layer.

The peculiar colour pattern seems, therefore, to be the only means of separating the two; and it seems to be sufficiently distinctive to justify specific rank. The only approach to a transitional pattern is that in the 3 specimens mentioned under *variegata*.

The pattern of *tabularis* is very constant, and is already distinct on the 3rd whorl (probably also on the 2nd if unworn): a series of protractive axial dark red streaks, bordered both fore and aft with pale green, on a paler reddish ground-colour, and extending over the periphery on to the paler base; streaks and intervals of approximately equal width; each streak usually continuous across the whorl, but may be disconnected in middle, and the lower part displaced forwards; sometimes 2 or 3 displacements occur; the streaks may be straight or slightly crinkly; an additional narrow wavy streak of green may be present on the intervals between two streaks.

Alt. and diam. 1.4 mm. (Krauss). No examples with the *tabularis* pattern have been seen equal in size to the largest *variegata*.

Radula as in *sinensis*.

Fossil: Quaternary, Sedgefield near Knysna (A. R. H. Martin).

Table Bay (Krauss); 'Cape of Good Hope', presumably Simon's Bay (False Bay) (Bartsch, N. Pacific Explor. Exp. coll. Stimpson); Kassouga and Port Alfred (Bartsch); Port Alfred (Turton).

Port St. Johns, Durban, and Tongaat (north of Durban) (S. Afr. Mus.); Delagoa Bay (U.W.).

Remarks. It is curious that there are no later records of *variegata* in Natal, and none of *tabularis* in Table Bay, the respective localities given by Krauss. Did Krauss accidentally transpose the two localities in his MS.? (Compare his Latin and German diagnoses of *Neritina umlaasiana*, loc. cit., p. 89). Nor has *O. tabularis* been collected in False Bay by Lightfoot, myself, or U.C.T. Probably therefore Stimpson obtained his specimen from an amateur collector, as seems to have been the case of the 5 *Littorina knysnaensis* stated to have been 'collected by Stimpson . . . at Port Elizabeth' (Bartsch, 1915, p. 120), although the N. Pacific Exploring Expedition did not touch at Port Elizabeth. I am indebted to Dr. H. Rehder, U.S. National Museum, for a photostat of the relevant pages from Stimpson's MS. Journal. Stimpson made no mention of having visited any localities outside the Cape Peninsula during the Expedition's stay in Simon's Bay, Sept. to Nov. 1853.

Gen. GIBBULA Risso

Our knowledge of the South African species of this genus is unsatisfactory. Gould described *loculosa*, *fulgens*, *articulata*, *fucata*, *musiva*, *gaudiosa*, *pintado*, all of which were accepted by Bartsch as valid species except *musiva*, a synonym of *cicer* (Menke). All the specimens on which these species were based were collected by Stimpson in Simon's Bay in False Bay. According to the numbers of each species given by Bartsch, about 30 specimens were collected: 21 were referred to *musiva* = *cicer*, and of the other species 1, 2, or at most 3 were obtained. Supposing that 50 specimens were collected, or even 100, does it seem likely that 7 species should be represented, all from one limited locality, and collected in a very brief space of time?

Turton based 9 new species on single specimens; and all from beach material.

No doubt one could continue picking out individuals from a large number of specimens, and bestowing names on them; thereby obscuring Nature's versatility in producing variations. The possibility of variation seems to have been overlooked, or subordinated to the desire to find 'new species'. Species with a spiral sculpture of main and intermediary lirae seem to be especially prone to variation.

Living shells dredged in shallow water, especially immature ones, often show a stronger sculpturing than living shells from the intertidal zone.

A pink coloration is a frequent phenomenon in beach-weathered shells. Investigation might show under what conditions this is most likely to occur. Even living specimens often have the apex, i.e. the part which has been longest exposed, tinged with pink.

The closure of the umbilicus is a variable feature, even in shells of the same size, and is unreliable as a specific character.

The following presentation is admittedly provisional. It has only been possible by the study of the material collected by U.C.T. Even so, far more material is required before one can state the number of species occurring on the South African coast. Beach-worn examples may sometimes be useful for giving a clue to the identity of some 'species' proposed in recent years.

The radulae of the species examined are alike. The radula of '*zonata*' is that of a *Gibbula*, not of an *Oxysteles*, in which latter genus it has been included by some authors.

Gibbula rosea (Gmelin)

Figs. 14 *j*, 18 *g, j*

Trochus roseus Gmelin, Krauss, 1848, p. 97.

Stomatella margaritana A. Adams, 1850, p. 33; 1854, p. 839, pl. 174, fig. 31.

Gibbula gaudiosa Gould, 1861, p. 21; Bartsch, 1915, p. 156, pl. 28, figs. 1-3.

Gibbula rosea Gmelin, Tomlin, 1921 *b*, p. 237.

Gibbula zonata (Wood)

Trochus cingulatus von Muhlberg, 1818, pl. 2, fig. xi; von Martens, 1903, pp. 55, 57 note 16.

Trochus zonatus Wood, 1828, p. 17, pl. 5, fig. 34 (n. et f.); Krauss, 1848, p. 97; von Martens, 1874, p. 129.

Trochus menkeanus Philippi, 1844, p. 91, pl. 3, fig. 6.

Gibbula leaensis Watson, 1880, p. 90 (named after Lea [*sic* = Sea] Point, Cape Town).

Gibbula zonata Wood, Watson, 1886, p. 76, pl. 6, fig. 7.

Oxysteles zonata Wood, Sowerby, 1892, p. 42.

Protoconch nucleus plus $3\frac{1}{2}$ -4 whorls (Watson, 1880: 6 !). Spiral lirae 1 on 1st whorl, 2 on 2nd, with a 3rd at and more or less absorbed in the suture, on 3rd whorl 3 main lirae; intermediaries present but variable, some of them sometimes almost as strong as the main lirae, which also show considerable variation in strength from ordinary lirae to outstanding costae or carinae.

On base (last whorl) numerous lirae, 9–16, varying in strength. Growth-lines fine, not pliculose. Umbilicus open in juvenile, usually closed in shells with diam. 3–4 mm., but may remain open in larger shells.

Up to alt. 7, diam. 10 mm.; 'high' and 'low' forms, e.g. 8×10 and 7×10 , 6.5×7 and 5.5×7 mm.

Coloration, living: cream, buff, grey, or purplish-grey, with darker grey or purplish lirae, those on the early whorls often pinkish or livery, the lirae on the later whorls often articulated light and dark. Beach specimens may retain the greyish or pinkish coloration, or may become bright pink with darker pink lirae.

Jaws present. Radula with *c.* 40 rows, central plate with broad lateral expansions, cusps on central and lateral plates with a few serrations, 1st marginal plate with broad base projecting inwards, the following plates feebly serrate on outer margin.

Table Bay (Krauss, Watson, also S. Afr. Mus.). Simon's Bay (False Bay) (Gould: *gaudiosa*). False Bay and Still Bay (S. Afr. Mus.). Port Alfred (Bartsch, Turton).

Off Keiskamma Point, 33 fathoms, 1 dead (S. Afr. Mus. P.F. coll.).

Living: Lüderitzbucht, Port Nolloth and various localities on west coast southwards to west coast of Cape Peninsula; and False Bay (U.C.T.).

Remarks. Considerable variation occurs in the strength of the main and intermediary lirae. Consequently it seems impossible to separate, conchologically, *rosea* and *zonata*, even as forms or subspecies. The respective references, however, are given separately. It is unfortunate that the earlier *rosea* must be retained, because it is applicable only to beach-weathered shells.

The darkest shells come from the west coast; towards the south on the west coast of the Cape Peninsula and in False Bay the shells tend to be paler, less suffused with grey, and the lirae more often pinkish. On the south coast also the lirae are more often articulated, even to the formation of more or less continuous axial streaks (*gaudiosa*; also shells from Still Bay). Some of the shells with these markings closely simulate *cicer*, as was noted by Krauss, but may be distinguished by the more numerous basal lirae.

Gibbula cicer (Menke)

Fig. 18 i

Trochus cicer Menke, 1844, p. 91, pl. 3, fig. 5; Krauss, 1848, p. 98.

Trochus zeyheri Krauss, 1852, p. 33.

Gibbula musiva Gould, 1861.

Gibbula cicer Menke, Bartsch, 1915, p. 156, pl. 30, figs. 8–10 (one of Gould's cotypes of *musiva*);

Wybergh, 1920, p. 66; Turton, 1932, p. 185, and pl. 45, no. 1296 (basal view of *musiva*).

Gibbula thalia Bartsch, 1915, p. 157, pl. 30, figs. 1–3.

Distinguished from *rosea* by the stronger liration on upper part of 3rd and 4th whorls, by the fewer and stronger basal lirae and by coloration.

Up to alt. 8.5, diam. 9 mm.; also 8×10 , 8×9.5 , 8×8 , 7.5×8 , 7×7.5 mm.

Radula as in *rosea*.

Coloration, living: pale cream, buff, or yellowish, with grey, purplish-grey, livery, or reddish spots or marks on the lirae, forming more or less continuous axial streaks, continued over periphery on to base, the early whorls yellowish, with continuous grey or red lirae. Shells from the west coast tend to be grey, those from the south coast more often, but not always, reddish. Beach shells retain more or less the same coloration, but may become pinker, especially on the early whorls.

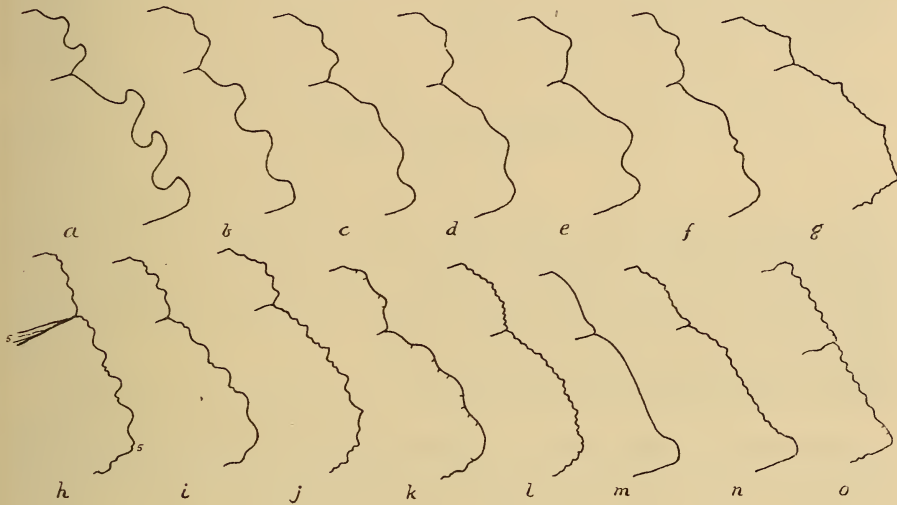


FIG. 18. Profiles of *Gibbula*: a-d, *multicolor* (Krss.); e, forma *biporcata* A. Adams; f, *multicolor* aberration (no. A8267); g, *rosea* (Gmelin), low form; h, *fulgens* Gould; i, *cicer* (Menke); j, *rosea*, high form; k, *beckeri* Sow.; l, *benzi* (Krss.); m, *tryoni* Pilsbry; n, *capensis* (Gmelin); o, *perspectiva* Sow.

Fossil: Pleistocene, Bredasdorp Beds, Port Beaufort (Wybergh).

Table Bay (Krauss). False Bay (Gould; also S. Afr. Mus.). Port Elizabeth (Sowerby). Port Alfred (Bartsch, Turton). Natal (Bartsch).

Hermanus, Still Bay, Mossel Bay (S. Afr. Mus.).

Living: numerous localities from Lüderitzbucht, Saldanha Bay and west coast of Cape Peninsula, and False Bay to East London and Quolora (U.C.T.).

Remarks. Sometimes difficult to distinguish from *rosea*. As a rule the coloration is distinctive, and correlated with broader, blunter lirae and narrower sulci. But transitional specimens do occur.

Both *rosea* and *cicer* occur on the west and south coasts, but the former seems to be commoner on the west coast, and the latter far commoner and extending farther east along the south coast.

Adam & Leloup (1938) identified specimens from Banda, East Indies, as *cicer*.

forma *fulgens* Gould

Fig. 18 h

Gibbula fulgens Gould, 1861, p. 21; Bartsch, 1915, p. 154, pl. 26, figs. 4, 5, 6.

An unusually 'high' form of *cicer*, and occurring in association with the typical form.

Alt. 8, diam. 7.5 mm. (Bartsch; also U.C.T.) and 7×6.5 mm. (U.C.T.).

In accordance with the coloration of west coast and south coast typical examples, the Langebaan examples have grey marks, the Cape Hangklip example red marks. Radula as in *rosea*.

Simon's Bay (False Bay) (Gould).

Living: Langebaan (Saldanha Bay) and Cape Hangklip (U.C.T.).

Gibbula multicolor (Krss.)

Fig. 18 a-f

Trochus multicolor Krauss, 1848, p. 97, pl. 5, fig. 31.

Gibbula fucata Gould, 1861, p. 20; Bartsch, 1915, p. 155, pl. 27, figs. 4-6.

Gibbula lauta Turton, 1932, p. 186, pl. 45, no. 1302.

Gibbula distincta Turton, 1932, p. 186, pl. 45, no. 1306.

Gibbula pulchella Turton, 1932, p. 187, pl. 46, no. 1307.

Gibbula polychroma Turton, 1932, p. 187, pl. 46, no. 1310.

Gibbula ornata Turton, 1932, p. 187, pl. 46, no. 1311.

Gibbula sp. Turton, 1932, p. 187, pl. 46, no. 1309.

Protoconch nucleus plus 3-4 whorls, elevated but diameter exceeding altitude, protoconch (if not worn) prominent. Spiral lirae 2 beginning on last part of 1st whorl, continued as strong costae on 2nd and 3rd whorls; actually a 3rd lira is present but included in the suture and not visible until the 4th whorl (or later part of 3rd); on body-whorl therefore 3 strong lirae or costae, subequally strong and usually equidistant, but 1st and 2nd may be a little farther apart than 2nd and 3rd. Sulci usually smooth except for the growth-lines. Intermediary lirae may develop but not very conspicuously, 3-5 between suture and 1st costa, and 2-5 (6) between the pairs of costae (cf. Turton's figure of *distincta*).

On base *c.* 12 more or less fine lirae, but variable, only 5 or 6 when no intermediaries are present, 2 or 3 of them may be slightly stronger than their neighbours. Umbilicus partially closed at shell diameter 4 mm., but may not be completely closed even in the largest shells.

In some examples growth-lines between 1st and 2nd lirae and between 2nd and 3rd (i.e. on body-whorl; on penultimate whorl between 2nd lira and suture below) form very regular retractive pliculae; when the pliculae are well developed the intermediary lirae are recessive or obsolete.

Alt. 6.5, diam. 7.5 mm.; also 5.5×7 and 5.5×6 mm.

Brown-red and white radiating stripes, best seen at the suture, upper 2 costae with alternating blue and orange-yellow spots, the lowest costa with

brown-red and white; base spotted with brown-red and white, then blue and orange, and rose and white near umbilicus (Krauss).

Similarly coloured examples from Natal (S. Afr. Mus.), but somewhat faded, especially the blue spots. No two of the 10 specimens are exactly alike. One is distinctive: ground-colour orange-yellow, with reddish radiating marks from suture to 1st lira on last whorl, the 3rd lira with alternating reddish-brown and pale yellow spots; base orange with paler spots and streaks. The Mossel Bay shell is similar but brighter orange, the radial streaks pale yellow, very faint on base.

The East London specimens are similar to those from Natal in coloration; the upper two lirae in one shell with pale green spots, deep peacock-blue spots in another.

The Buffels Bay example (taken alive) is buff with a few faint fulvous radiating marks and the two main lirae articulated with fulvous spots.

Beach examples from Table Bay rose-pink, uniform or with white or faded blue spots on the lirae.

Table Bay (Krauss; also S. Afr. Mus.); Simon's Bay (False Bay) (Gould, Bartsch: *fucata*); Buffels Bay and Gordon's Bay (False Bay), and Still Bay (S. Afr. Mus.); Port Elizabeth (Sowerby); Knysna (U.C.T.); Port Alfred (Bartsch, Turton); East London (S. Afr. Mus. coll. Lightfoot); Natal (S. Afr. Mus.).

Remarks. Bartsch's figures of Gould's cotype indicate clearly that *fucata* is a synonym.

Turton's *distincta* ('a single specimen') is a worn shell, with the intermediaries well developed on upper part of whorl; traces of the finer lirae on base are visible in the photo, though Turton said the spaces between the lirae were quite smooth.

forma *biporcata* A. Adams

Fig. 18 e

Stomatella biporcata A. Adams, 1850, p. 33; 1854, p. 893, pl. 175, fig. 43.

Gibbula bifurcata (*laps. cal.*) Sowerby, 1889 b, p. 153.

Gibbula fucata Sowerby, 1894, p. 372; Turton, 1932, p. 184, pl. 44, no. 1290, and var. *sowerbyi* no. 1291.

Gibbula biporcata Adams (MS.), Sowerby, 1892, p. 67, pl. 5, fig. 100; Tomlin, 1921 b, p. 237.

Gibbula hera Turton, 1932, p. 184, pl. 44, no. 1293 (*non hera* Bartsch).

Not so elevated as *multicolor*; with (typically) 2 spiral lirae, one slightly below middle of whorl and one peripheral, bluntly rounded, not so prominent as in *multicolor*, not costate. Intermediary lirae well developed but variable: usually one between suture and upper lira (corresponding with the 1st costa in *multicolor*) more prominent than the others, and sometimes as strong as the main lirae, thus producing a triliriate form; between the 2 main lirae also one intermediary may be stronger than its neighbours but never as strong as the aforesaid intermediary. Basal lirae as in *multicolor* but likewise variable. Umbilicus as in *multicolor*.

Alt. 5, diam. 6.5 mm.; also 5.5 × 7 and 6 × 7 mm.

Beach specimens from Table Bay as in *multicolor* from same locality: rose-pink, uniform, or with subsutural darker marks, or dark and pale alternating marks, lirae deeper red, with or without pale or faded blue spots.

Table Bay (S. Afr. Mus.); Cape Town (Sowerby: *fucata*); Port Alfred (Turton).

Remarks. This, in my opinion, is the less elevated bilirate form of *multicolor*. Probably it is the basic form, and *multicolor* the extreme cingulate form, but there is no sharp distinction between the two forms. The latter has taxonomic priority. In fact it is possible to find links connecting, conchologically, the less strongly lirate forms of *biporcata* with *rosea-zonata*; and only the mainly axial coloration separates them.

Gibbula benzi (Krass.)

Fig. 18 l

Trochus benzi Krauss, 1848, p. 99, pl. 5, fig. 32; von Martens, 1874, p. 129; Watson, 1886, p. 71.

Trochus ludwigi Krauss, 1848, p. 99, pl. 5, fig. 33.

Gibbula loculosa Gould, 1861, p. 21; Bartsch, 1915, p. 153, pl. 23, figs. 1-3 (one of Gould's cotypes); Turton, 1932, p. 188.

Gibbula pintado Gould, 1861, p. 21; Bartsch, 1915, p. 160, pl. 28, figs. 10-12 (Gould's Type); Turton, 1932, p. 186, pl. 45, no. 1298.

Gibbula kowiensis Turton, 1932, p. 187, pl. 46, no. 1308.

Gibbula benzi Krauss, Turton, 1932, p. 188, and var. *affinis*, p. 188, pl. 46, no. 1315.

Protoconch nucleus plus 5 whorls, profile convex though often slightly shouldered near middle of whorl, angulate at periphery on early whorls but becoming less distinctly so on later whorls, and quite rounded in largest shells. Spiral lirae 3 (4) on 2nd whorl, 4 or 5 main lirae on 3rd whorl, numerous on 4th and 5th whorls owing to interpolation of secondary lirae (c. 7-10 on 4th, c. 12-15 on 5th whorl). Basal lirae c. 15-20, with duplication and intermediaries sometimes up to 25. Umbilicus usually, but not always, completely closed in largest shells. Growth-lines distinct, often plicate.

Alt. 2.5, diam. 3 mm., up to 12 × 14 mm. High and low forms, e.g. 6.5 × 7 and 5.5 × 7, 9.5 × 11 and 8 × 11 mm.

Ground-colour variable, brown, red, orange, uniform or with white or pale yellow radiating streaks, pale marks on the peripheral angle, lirae usually articulated, necklace-like. In a series of 28 shells from Mossel Bay 11 are almost uniformly deep orange. The U.C.T. shell from False Bay (living) is uniform dull drab; and the Langebaan shell (living) bluish-grey with darker and lighter patches around the periphery. The *Pieter Faure* and U.C.T. specimens from Table Bay (living) are pale biscuit-colour, with or without brown spots on the lirae.

Radula similar to that of *rosea*.

Cape (Krauss); Simon's Bay (False Bay) (Gould, Bartsch: *loculosa*, *pintado*); False Bay (von Martens); False Bay, Still Bay, Mossel Bay (S. Afr. Mus.); Port Alfred (Bartsch, Turton; also S. Afr. Mus.).

Off Cove Rock (East London), 22 fathoms, 9 and fragments; 34° 5' S., 25° 55' E., 67 fathoms, 7 juv. (S. Afr. Mus. P.F. coll.).

Living: False Bay, 15–20 fathoms (Watson: presumably living); Table Bay, 22 fathoms (S. Afr. Mus. P.F. coll.); Langebaan (Saldanha Bay), Table Bay, and False Bay (U.C.T.).

Remarks. It seems a little strange that Krauss separated *ludwigi* (a 'distinctive' species) from *benzi*; he may have been influenced by the colour and the well-developed growth-lines. But both of these features are found to be variable when a large series is available. In the *loculosa* form the growth-lines are particularly well developed.

The brightly coloured shells are all beach-weathered shells from south coast localities.

Although at first sight the synonymy seems strained and unlikely, the variation in the development of the main and secondary lirae, and of the growth-lines, seen in a long series, amply accounts for the institution of *ludwigi*, *loculosa*, and *pintado*. In Gould's Type of *pintado* (figured by Bartsch) and one of the *Pieter Faure* specimens there are, respectively, 7 and 8 or 9 main lirae, of equal strength, and no intermediaries. Usually, however, the lirae differ distinctly in strength, some being evidently intermediaries.

The Langebaan shell (which is the largest I have seen) has the intermediaries on the 3rd–5th whorls (apex and 2nd whorl worn) so well developed as to be indistinguishable from main lirae, and without reference to a series of *benzi* might be thought to be a different species. In fact it is very like a *capensis*, which occurs in the same locality, with the profile rounded or scarcely angular at the periphery.

It may be useful to retain the name *pintado* as a form of *benzi*, but not *loculosa* which applies merely to strongly sculptured unworn *benzi*.

Gibbula capensis (Gmelin)

Fig. 18 n

Trochus capensis Gmelin, Krauss, 1848, p. 100; Wood, 1856, p. 141 (*capensis* Gmelin for *variegatus* Chemn.).

Gibbula capensis Gmelin, Sowerby, 1892, p. 43; Haughton, 1932, p. 34.

Protoconch nucleus plus 5 whorls; profile evenly convex but with a slight shoulder, strongly carinate at periphery. Spiral lirae 3 on 2nd and 3rd whorls, but the 3rd (peripheral) lira is more or less embedded in the suture; 1, later 2 intermediaries between suture and 1st lira and between the two pairs of lirae; on 3rd whorl the 2nd lira decreases in strength, and a little later the 1st also decreases, so that on 4th whorl there are 8–10 subequal lirae, and on 5th whorl 10–13 between suture and carinal lira; the shoulder remains more or less distinct in the position of the original 1st lira.

On base of 3rd whorl 4 main lirae, on 4th 5–6, on 5th 6–7; fine intermediaries may occur, giving a total on 5th whorl of *c.* 15 lirae. Umbilicus open

in largest shells. Growth-lines distinct, in good specimens often pliculose between the lirae.

Alt. 2.5, diam. 4.5 mm.; also 3.5 × 5, 3.5 × 6, 4 × 7, 4.5 × 6, 6.5 × 11, 7 × 12, 9.5 × 11, 10 × 12, and 10 × 13 mm. Krauss: 11.5 × 15 mm.

Apex (2nd whorl) often with pink or violaceous articulated lirae on a pale ground-colour; but these spots soon develop into axial streaks of red or violaceous brown, often with darker borders, on a pale or greenish ground-colour; the streaks often faint or interrupted at midwhorl but reappearing prominently on the peripheral keel; basal lirae pink, uniform or articulated. There are several variations of this colouring and pattern, which is often particularly bright on beach-worn specimens.

Radula as in *rosea*, but central plate more triangular.

Fossil: Quaternary, Hoedjes Bay (Saldanha Bay) (Haughton).

'*An der ganzen Südspitzen*' (Krauss); Port Elizabeth, Natal, etc. (Sowerby); Dassen Island (north of Table Bay), False Bay, Hermanus, Still Bay (S. Afr. Mus.).

Living: Langebaan (Sandanha Bay); west coast of Cape Peninsula; Cape Hangklip (U.C.T.).

Remarks. A distinctive species with 'high' and 'low' forms (see measurements). The largest shells are usually high (cf. Krauss).

The peripheral keel is typically well marked, not only structurally, but by the necklace-like alternating dark and light spots. But occasionally high shells occur with the periphery only angular, not carinate.

One of the Still Bay high shells has a rounded periphery as in *O. tabularis*, and a similar colour-pattern, the axial streaks being continuous from suture to periphery and passing over on to base; but it has spiral lirae and an open umbilicus, and therefore cannot be *tabularis*.

In the low form the peripheral carina is always prominent, which obviates confusion with some juveniles of *rosea*, *multicolor* and *biporcata*, especially when the latter have acquired a pink tinge.

Eight shells from Langebaan provide a more puzzling question. In colour they are livery or violaceous, the lirae darker, a series of white spots at top of whorl below suture and another series around periphery, the two series separate or more or less connected by pale axial streaks; base uniform or the lirae articulated; umbilicus pinkish. When the pale axial streaks are continuous the resemblance to *capensis* is strong, but where there are only the sutural and peripheral white spots the resemblance is more towards some of the south coast colour varieties of *benzi*. The profile of the body-whorl is like that of *benzi* or the high forms of *capensis* which have a rounded periphery.

Gibbula beckeri Sow.

Fig. 18 k

Gibbula beckeri Sowerby, 1901, p. 214, pl. 22, fig. 22 (not very good).

Protoconch nucleus plus 4 whorls; profile rather strongly convex in upper half of whorl. Spiral lirae 2 on 2nd and 3rd whorls, 3 on 4th, broad and low, scarcely projecting above the profile, defined by impressed striae, the 3rd being peripheral and feebly carinate; an additional stria (or 2) between 1st and 2nd lirae, and 2-3 between 2nd and 3rd. Sometimes (as in a cotype) only 1 (midwhorl) lira on 2nd and 3rd whorls, but the peripheral one comes into view on 4th whorl.

On base usually a marginal lira and 7-8 weaker lirae, variable. Umbilicus not completely closed in largest shells. Growth-lines distinct.

Alt. 5, diam. 7 mm. (cotype); 7×9 mm.

Grey or violaceous-grey with white or pale spots, radiating streaks, and/or zigzag marks, very young shells (up to 2-3 mm. diam.) uniformly violaceous.

One specimen yellowish with darker brown radiating patches forming a band below suture, similar dark patches on the peripheral lira, between these two bands brown zigzags.

Two specimens have red-brown radiating streaks on an emerald-green ground-colour on 3rd and 4th whorls, streaks extending on to peripheral lira (cf. *capensis*). Base with grey lirae, or faintly streaked and spotted.

Radula as in *rosea*.

Kowie = Port Alfred (Sowerby). Sea Point (Cape Town) (S. Afr. Mus. coll. Lightfoot 1893).

Living: Port Nolloth, Buffels River, Hondeklip Bay and Steenberg Cove (west coast); Cape Peninsula; and Knysna (U.C.T.).

Remarks. A puzzling species, if it is a species. Up to the present the large *tryoni* has not been found on the west coast; otherwise one might be tempted to regard the above-described specimens as juvenile *tryoni*. On the other hand there is the likeness to *multicolor*-*biporcata*. Provisionally, therefore, *beckeri* is retained.

Turton did not obtain it, or at least did not record it under this name, at the type locality.

Sowerby's Latin description might apply to *multicolor*: '*anfractus . . . penultimatus supra bicarinatus, . . . ultimus tricarinatus.*' His English comment mentions: 'deep furrows and strong keels.' His figure, however, shows only 2 lirae (midwhorl and peripheral) on the body-whorl; it might almost have been drawn from a *capensis*!

A cotype from the Kowie presented by Dr. H. Becker agrees with Sowerby's description in colour, and has 3 lirae on the body-whorl. These lirae, however, are very low and rounded, the upper one is represented by barely more than a slightly greater convexity of the profile, the midwhorl lira is delimited above by an incised stria, and the peripheral lira is not so prominent as in Sowerby's figure. Intermediaries very faint, but 3-4 between the midwhorl and peripheral lirae on body whorl.

In some specimens the main lirae or intermediaries are scarcely raised above the profile and are indicated only by incised striae; in some juveniles the surface from suture to periphery is quite smooth, and the periphery is

only very feebly angular. A Knysna specimen is like *aglaia*, having the appearance of being 'wrapped by turns of a bandage' (Bartsch).

When the 1st and 2nd lirae are suppressed and only the peripheral one remains, the shell approximates to the early whorls of *tryoni*, especially as the latter often has 2 'necklaces' of coloured spots which are in the same position on the whorl as the 1st and 2nd lirae in *beckeri*, and, though only coloured, simulate raised lirae. Occasionally a specimen occurs without any spiral sculpture.

In juveniles the growth-lines are often very distinct, in fact almost pliculate. In one of the Knysna shells there are major growth-lines at regular intervals, forming well-marked retractive axial pliculae—an unusual feature among South African species of *Gibbula*.

Gibbula tryoni Pilsbry

Fig. 18 m

Gibbula tryoni Pilsbry, 1889, p. 239, pl. 69, figs. 20, 21; Turton, 1932, p. 189.

Gibbula incinta Sowerby, 1894, p. 372; 1897, p. 18, pl. 6, fig. 22 ('= *tryoni*').

Gibbula aglaia Bartsch, 1915, p. 158, pl. 27, figs. 1-3 (= juv.).

Gibbula medusa Bartsch, 1915, p. 159, pl. 29, figs. 7-9 (= juv.).

Protoconch nucleus plus 6 whorls; profile evenly convex, angulate at periphery. Early whorls may have 2 or 3 very feebly developed spiral lirae, and a stronger peripheral keel, more or less visible in the suture; later whorls with peripheral keel usually marked off by a feeble groove from the surface above, which (in good specimens) is covered with exceedingly fine spiral striae. Growth-lines distinct, becoming rather coarse on body-whorl in large shells. Umbilicus widely open.

Alt. 5, diam. 6 mm.; also 8×11 , 10×10 , 10×12 , 11×12 , up to 16×16 mm. and 19×20 mm.

Ground-colour brown, yellowish-brown, olive, reddish, usually with dark marks radiating from suture, alternating with pale marks, or pale marks only; one, two or three characteristic necklace-like spiral bands articulated with dark and pale spots; on early whorls sometimes green spots.

Port Elizabeth (Sowerby). Port Alfred (Bartsch, Turton, also S. Afr. Mus.), Port St. Johns, and Tongaat (Natal) (S. Afr. Mus.).

Remarks. A large and distinctive species, umbilicate, and with only 1 well-developed spiral lira—the peripheral keel; but on the last whorl in the largest shells this keel tends to disappear.

The spiral necklaces, being sharply defined, often simulate raised lirae.

Bartsch's two species are regarded as juveniles. But the growth of *tryoni* should be traced back to its juvenile stage by obtaining good (living) material. See also *beckeri*.

Gibbula perspectiva Sow.

Fig. 18 o

Gibbula perspectiva Sowerby, 1900, p. 6, pl. 1, fig. 17.

Protoconch nucleus plus 6 whorls; conical, profile straight, angulate at periphery. Apex worn; spiral lirae 4 on 3rd whorl, 5-6 on 4th, 6-7 on 5th and 6th whorls, including one or two fine intermediaries; in addition a peripheral carinal lira slightly broader than those above it, but not projecting beyond profile, divided by 1 (5th whorl) or 2 (6th whorl) faint striae; in apical view the peripheral keel is slightly undulate; on 6th whorl lirae may be feebly granulate; suture slightly undulate. Base with 6 lirae. Growth-lines distinct, more or less pliculose in the sulci. Umbilicus widely open.

Alt. 8.5, diam. 9 mm. (cotype); another: 7.5 × 7.5 mm. Sowerby: 10 × 11 mm.

Mottled red on pale ground-colour, faint darker patches from suture extending more or less across whorl, peripheral carina articulated, basal lirae spotted (cotype). Another specimen uniform fulvous-brown.

Pondoland coast (Sowerby, also S. Afr. Mus.). A second specimen in the South African Museum (Juritz coll.) probably came also from Port Alfred, but possibly from Natal.

Remarks. The present cotype (coll. Becker) is not in very good condition, but exhibits characteristics (number of lirae) not mentioned in Sowerby's description.

Not taken by Turton at Port Alfred.

Related to *townsendi* Sow., described from the Mekran Coast, and recorded by Smith (1903) from Durban.

Cantharidus fultoni (Sow.)

Figs. 14 i, 19

Calliostoma fultoni Sowerby, 1889 b, p. 153, pl. 3, fig. 7 (labelled *Trochus stenomphalus*); 1892, p. 43, pl. 2, fig. 43; Schwarz, 1910, p. 115; Tomlin, 1931 a, p. 419 (note on *stenomphalus*), Houghton, 1937, p. 22.

Calliostoma farquhari Sowerby, 1892, p. 43, pl. 2, fig. 42; Schwarz, 1910, p. 115; Tomlin, 1931 a, p. 419.

Calliostoma bisculptum Smith, 1906 a, p. 54, pl. 8, fig. 4.

Calliostoma ? n.sp. Smith in Rogers, 1906 b, p. 293.

†*Calliostoma mosselense* Tomlin, 1926 b, p. 81; Houghton, 1926, p. 81 (note on Tomlin); Barnard, 1962, p. 182.

Conical, altitude greater than diameter, but proportionately greater in large shells than in juveniles. Protoconch nucleus plus 8 whorls; profile straight, angularly carinate at periphery, sharply on the early whorls but less so on later whorls, carina often making a slight bulge above the suture. First whorl obscurely spirally striate, following whorls with spiral lirae, varying in number from 6 broad flat lirae to 18 fine filiform lirae. Base with 8-13 lirae. Growth-lines fine, close, oblique. Umbilicus variable, usually almost or quite closed in shells of about diam. 8-9 mm., but even in largest shells a narrow chink may remain.

Up to alt. 16, diam. 13 mm.

Grey or pale buff, sometimes with a livid or faint greenish tinge, usually with more or less distinct darker grey protractive axial streaks, flames, or

zigzags, sometimes in duplicate or bifid towards the periphery, lirae more or less articulate, peripheral carina distinctly articulated; often 2 thin red spiral lines, 1 below suture and 1 midwhorl, sometimes a third red line above the peripheral carina. Base paler, speckled or with axial streaks, and often 1-3 red spiral lines. Juvenile shells often iridescent externally, especially in alcohol.

Some of the Mossel Bay and Sedgfield fossil shells retain traces of the axial streaks.

Jaws present, without intercalated platelets. Radula with *c.* 50-55 rows, central plate expanded laterally, 5 lateral plates with broad cusps, with one or two serrations, marginal plates not serrated.

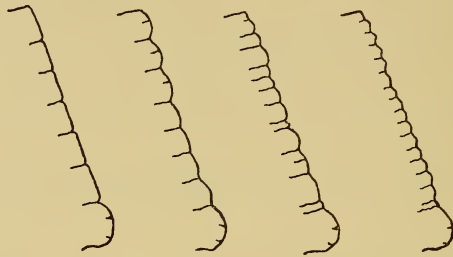


FIG. 19. Profiles of *Cantharidus fultoni* (Sow.) to show variation.

Fossil: Quaternary, Klein Brak River (Mossel Bay) (Tomlin: †*mosselense*); Port Elizabeth (Johnson; Schwarz; Haughton); Sedgfield near Knysna (A.R.H. Martin); Knysna raised beach (S. Afr. Mus.).

Port Elizabeth (Sowerby); Durban (Smith); Isipingo and Durban (S. Afr. Mus.).

Off Cape Morgan, 47 fathoms, 1 dead (S. Afr. Mus. P.F. coll.).

Living: Delagoa Bay (S. Afr. Mus. coll. K. H. B.; also U.W.); Inhambane and Maxixe (U.C.T.); Mozambique Island (U.W.).

Remarks. Sowerby's description of *fultoni* and Smith's description of *bisculptum* are very similar, sometimes with almost *ipsisima verba*: ('*strigis plerumque duplicatis*' and '*strigis plus minus duplicatis*'); Smith, however, did not mention *fultoni*, and did not compare his species with any other.

Tomlin (1931a) showed that *farquhari* was only juvenile *fultoni*; and mentioned some features which appeared to separate the unique specimen of *bisculptum* from *fultoni*, but foresaw the possibility of these differences being bridged by further material.

Tomlin, according to Haughton's note (1926), had only one specimen from Mossel Bay, and therefore was unaware of the variation in the liration and in the umbilicus. His statement that *farquhari* was 'much smaller' than *mosselense* was not quite correct: Sowerby gave 12 × 9 mm. for the former, Tomlin 12 × 10 mm. for the latter.

Both Sowerby and Tomlin regarded *fultoni* as close to the Madagascan

Trochus suarezensis Fischer 1880, later transferred to *Cantharidus* (see Dautzenberg, 1929, p. 538). A comparison of a series from Madagascar and the east coast of Africa might be interesting.

The radula shows that *fultoni* is not a *Calliostoma*.

The variation in the number of lirae is remarkable but not unexpected in the case of a lirated shell. The most common, and therefore to be regarded as normal, form is multilirated. There is one 6-lirate shell from Delagoa Bay; but the longest series from any one locality is that from Mossel Bay, most of which are in good condition. Variation on the whorl does not always coincide with that on the base: shells with multilirated whorls usually have a multilirated base, but not always.

Haughton's statement (1937) that *mosselense* was extinct must be qualified. Like *Cerithium kochi* (Barnard, Part III, p. 131) this species at one time was living much farther westwards along the coast than it is today. It is doubtful if it is living as far south as Port Elizabeth. One may even doubt whether it is living on the Natal coast; Burnup's unique specimen of *bisculptum* (? living) and 2 dead shells in the South African Museum appear to be the only records.

In the Mossel Bay raised beach *fultoni* is one of the most abundant species.

Angaria lacunosa n.sp.

Fig. 20

A worn specimen, the upper surface partially covered with a Polyzoan, seems to belong to this genus. The upper surface is irregularly oval in outline, 9×8 mm.; a faint suture is visible in places. Three cavities appear to represent apertural expansions on previous whorls; one such cavity is at the upper corner of the aperture, and one slightly behind it. Base convex, with traces of spiral lirae, best seen near the narrow umbilicus, which is not completely covered by the columellar glaze.

From one of the *Pieter Faure* bottom-samples from Natal, but exact locality not recorded (S. Afr. Mus. A9281, P.F. coll.).

May possibly be *atrata* (Gmelin).

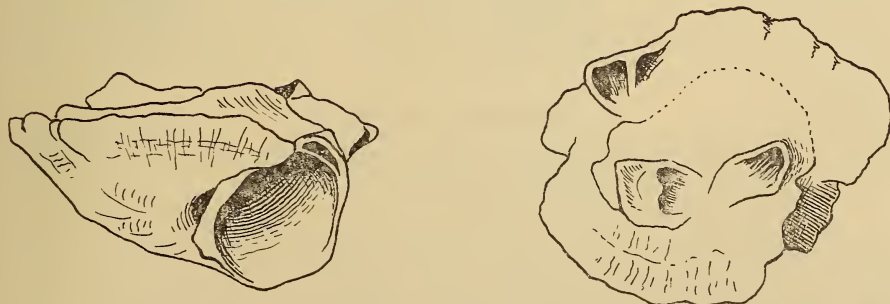


FIG. 20. *Angaria lacunosa* n. sp., frontal and apical views.

Umbonium vestiarius (Linn.)

Rotella vestiaria Linn., Chenu, 1859, figs. 2592-2603 (coloured).

Recorded by Sowerby (1897) from Durban. The South African Museum has it from Kentani (coll. Rev. F. C. Kolbe), but the record needs confirmation. Bartsch's (1915) 'Cape of Good Hope' is not a definite locality, and merely means that the specimens were in a collection received from 'South Africa'.

Turton (1932, p. 183) recorded '*Omphalius fasciatus* Born', identified by Tomlin. 'Smooth, with brown marks and spiral dotted lines . . . rather like a *Solarium*.' Turton seems to have made some mistake, because his words suggest *Umbonium*; *Omphalius* is not at all like a *Solarium*.

Fam. **Fissurellidae**

Thiele, 1929, i, p. 31.

Tomlin, 1932, p. 159 (South African species).

The radula seems to require further investigation. Powell (1951, p. 87, fig. G 3) described and figured the radula of *Parmaphorella melvilli* with an 'incipient or obsolescent' 6th lateral plate, and noted that a similar plate is present in other genera. It seems to be distinct in this genus, and simulates a lateral plate; but as the fan-like series of marginal plates is closely associated with this plate, and in *Amblychilepas scutella* (fig. 21 b) appears to be actually attached to it, it would be better interpreted as the 1st marginal plate. It is absent in *Pupillaea aperta* (fig. 21 e), but its homologue seems to be the alate 1st marginal plate.

This latter plate may represent an evolutionary stage, because in *Diodora parviforata* it is present but lacks the slender process at the outer corner.

Torr (1914, pp. 363, 364) described a double row of marginal plates in *Megatebennus* (*Cosmetalepas*), *Lucapinella*, and *Emarginula*; presumably meaning a double row belonging to each transverse row of plates on the radula. This, at least in all the radulae I have been able to examine, is an illusion due to the series of marginals being directed backwards parallel with the axis of the radula instead of spreading out more or less laterally. Consequently when the marginals are numerous, those belonging to one transverse row overlap those of the row in front (fig. 21 a). In *A. scutella* (fig. 21 b), however, the marginals are not numerous, and all are accommodated on the well-'chitinized' basal plate.

Fissurella robusta Sow.

Fissurella robusta Sowerby, 1892, p. 48, pl. 2, figs. 50, 51; Tomlin, 1932, p. 160; Haughton, 1929, p. 38, pl. 9, figs. 1-3; 1932, pp. 23, 27, 29, 30, 42.

Tomlin declined to admit this large species to the list of Recent shells on account of its fossilized appearance. Probably the original specimen had been washed out of Pleistocene deposits in the neighbourhood of Port Elizabeth, like *Cerithium rufonodosum* (see: Barnard, Part III, p. 131) and *Priotrochus alexandri* (p. 251, *supra*).

Houghton recorded it from Late Tertiary or Pleistocene deposits north of Orange River Mouth, Alexander Bay, Port Nolloth, and north of Olifants River mouth.

Up to $81 \times 62 \times 40$ mm.

Franca (1960, p. 11, pl. 1, fig. 1) recorded 2 large examples of *Fissurella*, 57 and 62 mm., from Tiger Bay, Angola, and identified them with a query as *F. tanneri* Verrill 1883. It seems unlikely that this American species occurs on the Angolan coast.

Subfam. **Fissurellinae**

Central plate of radula narrow, 5th lateral plate with 4 cusps.

Fissurella mutabilis Sow.

Fig. 21 a

- Fissurella mutabilis* Sowerby, 1834, p. 127; Krauss, 1848, p. 65; Watson, 1886, p. 33; von Martens, 1903, p. 50; Odhner, 1923, p. 32; Tomlin, 1931 a, p. 418.
Fissurella mutabilis var. *aurantia* Sowerby, 1921, p. 127; Turton, 1932, p. 205.
Fissurella mutabilis var. *obtusata* Sow., Turton, 1932, p. 205.
Fissurella rota Rve., Turton, 1932, p. 205.
Fissurella sagittata Rve., Turton, 1932, p. 205.
Fissurella alboradiata Turton, 1932, p. 205, pl. 53, no. 1424.
Fissurella indistincta Turton, 1932, p. 206, pl. 53, no. 1427.

Not saddle-shaped, lies flat. Foramen narrow, keyhole-shaped.

Animal, except the head, covered by the shell. Grey or brownish sole pale.

Radula with 45-55 rows, central plate triangular, very narrow in front, 4th lateral plate with an inner flange and tapering apex, 5th lateral with 4 cusps, marginal plates *c.* 22-26 attached to an alate basal plate but continued slightly beyond its hind end and attached to the basal membrane of the radula, thus slightly overlapping the series on the row behind, the hindermost 4-6 obovate, spatulate.

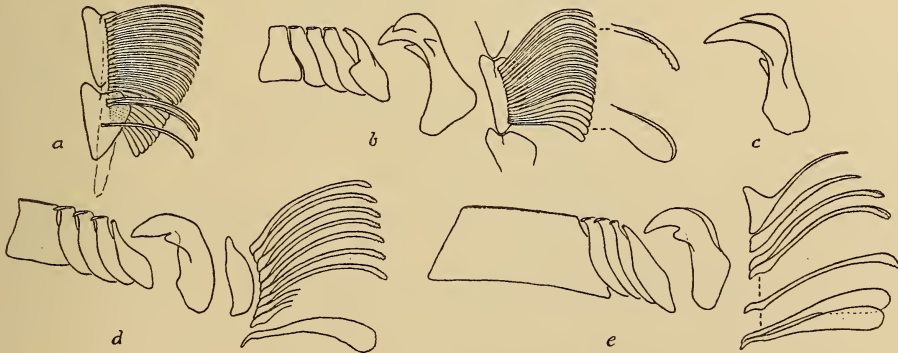


FIG. 21. Radula plates of: a, *Fissurella mutabilis* Sow., two series of marginal plates, the lower series not completely drawn; b, *Amblychilepas scutella* (Gmelin); c, *Megatebennus* (*Cosmetalepas*) *africanus* Tomlin, 5th lateral plate; d, *Tugalia barnardi* (Tomlin); e, *Pupillaea aperta* (Sow.), adult.

Fossil: Pleistocene; Algoa Bay (Johnson, 1904); Little Brak River (S. Afr. Mus.).

Lüderitzbucht, Table Bay, False Bay to Port Alfred, and Natal (*auct. et* S. Afr. Mus.). 34° 8' S., 24° 59' E., 80–100 metres (von Martens).

Living: Lüderitzbucht, Port Nolloth to Langebaan (Saldanha Bay); West coast of Cape Peninsula; False Bay, and various localities to Kleinmond (Bathurst Div.) (U.C.T.).

Distribution. Madagascar (Odhner); St. Paul and New Amsterdam (southern Indian Ocean), *vide* Velain (*Faune St. Paul. Moll.*, p. 120, pl. 4, figs. 11, 12) and von Martens (*loc. cit.*, p. 71).

Fissurella natalensis Kruss.

Fissurella natalensis Krauss, 1848, p. 66, pl. 4, fig. 8; Schwarz, 1910, p. 115; Dautzenberg, 1929, p. 545; Braga, 1952, p. 93, pl. 6, fig. 8; Janus, 1961, p. 3, pl. 1, figs. 7–9.

Diodora natalensis Krauss, Day & Morgans, 1956, p. 306 (listed); Macnae & Kalk, 1958, p. 127 (listed).

Not saddle-shaped, nor flat, sides slightly concave so that shell rests on front and hind ends. Foramen keyhole-shaped. Up to 50 × 30 mm.

Animal covered by shell. Dark grey or brown, mottled or speckled, mantle edge with squarish dark marks, head dark, sole pale.

Radula with *c.* 55 rows, as in *mutabilis*.

Fossil: Pleistocene, Port Elizabeth (Schwarz).

Port Elizabeth (Sowerby). Port Alfred (Bartsch, Turton); Natal (Krauss; also S. Afr. Mus.); Delagoa Bay (Braga).

Living: Richmond (Alexandria Division), East London (U.C.T.), Morgan Bay (S. Afr. Mus. coll. Mrs. Kerr), Umzimkaba (F. Talbot), Durban and Umhlali (U.C.T.), Delagoa Bay (U.W.).

Lectotype in Stuttgart Museum.

Distribution. Madagascar (Dautzenberg).

Amblychilepas scutella (Gmelin)

Figs. 21 *b*, 22 *d–f*

Fissurella trapezina Sowerby, 1834, p. 126.

Fissurella scutella Gmelin, and var. *trapezina* Krauss, 1848, p. 63.

Fissurella incarnata Krauss, 1848, p. 65, pl. 4, fig. 7; Sowerby, 1892, p. 47.

Fissurella dubia Sowerby, 1862, p. 193, pl. 244, fig. 208.

Fissurellidea sella Sowerby, 1862, p. 203, pl. 243, fig. 197.

Fissurellidea hiantula non Lam., Sowerby, 1892, p. 48.

Megatebennus (Amblychilepas) scutella Gmelin, Smith, 1903, p. 391; Haughton, 1932, pp. 34, 43.

Fissurellidea scutella Gmelin, Turton, 1932, p. 207.

Fissurellidea incarnata Krauss, Turton, 1932, p. 206, and var. *maculata*, pl. 53, no. 1431.

Fissurellidea multilineata Turton, 1932, p. 206, pl. 53, no. 1432.

Fissurellidea albanyana Turton, 1932, p. 207, pl. 54, no. 1433.

Fissurellidea nigrostriata Turton, 1932, p. 207, pl. 54, no. 1435.

Megatebennus [sic] scutellum Gmelin, Krige, 1933, p. 37.

Megatebennus incarnatus Kruss., Janus, 1961, p. 3, pl. 1, figs. 4–6.

Saddle-shaped, foramen oval; radiating lirae numerous but variable in

strength: coarser, more or less unequal, some of them especially at both ends distinctly stronger than others (*scutella*), or finer and more regular (*incarnata*); growth-lines subordinate to the lirae but often, especially in *dubia-scutella*, forming squamose nodules, sometimes when well developed (and unworn or uncorroded) forming continuous concentric crinkly lines. Up to 35×22 and 37×22 mm., alt. 10–11 mm.; high and low forms, e.g. long. $19 \times$ alt. 5.5 and 18×3 mm. Sometimes strongly saddle-shaped, the upper surface nearly level instead of sloping down from the foramen (*sella*). Smallest seen: 1.5×0.75 mm. (coll. Muir).

Colour on west coast usually grey or drab, with more or less distinct darker radial streaks; white with black radial streaks (Lüderitzbucht); on south coast often brighter, tending to pink or reddish. Beach shells very variable in colour and pattern, but probably the colours accentuated by weathering.

Animal much larger than shell, projecting and elevated posteriorly, propodium projecting triangularly forwards, in preserved specimens usually concealing the snout in ventral view (contrast *mutabilis*); animal (as preserved) 46 mm. long with shell 33 mm. Surface nodulose and granulose, cirri projecting from around margin of shell. Chestnut-brown or reddish, sole dark.

Radula with 30–35 rows, central plate narrow in front, broader behind, 1st–3rd lateral plates narrow-oblong, 4th with projecting inner flange and tapering apex, 5th large, with 4 cusps, marginal plates not numerous, attached to an oval-alate basal plate, slender, distally minutely serrulate, the hindermost 3–4 elongate-obovate, spatulate.

Fossil: Pliocene; Inhambane, Portuguese East Africa (Cox, 1939). Quaternary; Hoedjies Bay and Saldanha Bay (Haughton); Klein Brak River, Mossel Bay (S. Afr. Mus.); Sedgfield near Knysna (A. R. H. Martin); Durban (Krige; also Geol. Survey).

Table Bay and False Bay to Natal (*auct. et S. Afr. Mus.*).

Off Cape Vidal (Zululand), 22 fathoms, 2 juv. dead, fresh; off O'Neil Peak (Zululand), 90 fathoms, 2 dead, worn (S. Afr. Mus. P.F. coll.).

Living: Table Bay and False Bay (S. Afr. Mus.); Hoedjies Bay (Saldanha Bay), low tide (S. Afr. Mus. P.F. coll.); Elizabeth Bay (south of Lüderitzbucht), Groen Rivier and Zout Rivier; Langebaan (Saldanha Bay), False Bay, and various localities to Durban (U.C.T.).

Lectotype of *incarnatus* in Stuttgart Museum.

Remarks. Although the coarsely lirate *scutella* and the finely lirate *incarnata* appear quite distinct, all transitions can be found in a long series from one locality (e.g. Still Bay, coll. Muir). Some Durban examples, and the O'Neil Peak shells, have very coarse lirae with well-marked squamose nodules (*dubia*); the Cape Vidal unworn juveniles have the concentric crinkly growth-lines more conspicuous than the lirae.

Juveniles below about 7–8 mm. long, before they have become distinctly saddle-shaped, are often difficult to distinguish from *mutabilis* even when the foramen is undamaged.

In the Muir collection there is a very young shell 1.5×0.75 mm. retaining the protoconch, which appears referable to this species; at 2 mm. long all trace of the protoconch has been lost.

The fossils from Klein Brak River are very young, the largest only 5 mm. long, and are narrower than juveniles of similar size from, for example, Still Bay; they may possibly be *mutabilis*, though the foramen seems to be oval, not keyhole-shaped.

Macrochisma africana Tomlin

Macrochisma producta (non A. Adams) Sowerby, 1892, p. 48.

Macrochisma compressa (non A. Adams) Sowerby, 1897, p. 11.

Macrochisma producta A. Adams var., Smith, 1901, p. 105.

Macrochisma africana Tomlin, 1932, p. 161, fig. 3.

Saddle-shaped. The present specimens agree with and add nothing to Tomlin's description. The largest specimen is the same size as Tomlin's Type: 22×10 , alt. 7 mm. The *Pieter Faure* specimen is slightly narrower: 17.5×7 mm.

Port Elizabeth (Sowerby); Port Alfred, Scottburgh (Natal), and Umvoti (Natal) (Tomlin). Durban (S. Afr. Mus. coll. R. M. Lightfoot); Scottburgh (S. Afr. Mus. coll. K. H. B.).

Off O'Neil Peak (Zululand), 90 fathoms, 1 dead, worn (S. Afr. Mus. P.F. coll.).

Type ? in coll. Tomlin.

Subfam. **Emarginulinae**

Central plate of radula broad, 5th lateral plate with 2 (occasionally 3) cusps.

Fissurellidea (Pupillaea) aperta (Sow.)

Fig. 21 e

Fissurella aperta Sowerby, 1825, p. vi.

Pupillaea aperta Sow., Krauss, 1848, p. 62, pl. 4, fig. xi; von Martens, 1874, p. 127; 1903, pp. 55 and 57 note 18.

Slightly saddle-shaped; inner layer of shell projecting beyond the outer coloured layer; foramen very large, about $\frac{1}{3}$ length of shell, oval; radiating lirae more or less subequal, often less strongly developed at sides than at ends; growth-lines distinct, crinkly where they cross the lirae. Up to 40×28 , foramen 15×10 mm., and 50×32 , foramen 15×10 mm.; broad and narrow forms, e.g. 24×17 and 28×15 mm. Smallest seen: 10×6.5 , foramen 3.5×2 mm.

Grey with darker grey or livery radiating stripes of varying width. Beach shells often buff or fawn with fulvous stripes.

Animal much larger than shell, mantle completely covering shell up to edge of foramen. Flesh-coloured, grey, dark brown, or blackish, more or less mottled, sole paler. Up to approximately 110×80 mm. (as preserved).

Radula with 30–35 rows, central plate oblique, very broad, front margin slightly thickened and sometimes extremely finely serrulate, 1st–4th lateral plates narrow, with small overturned apices, 5th lateral very large, with strong uncinat cusp and small external cusp, marginal plates numerous, posteriorly overlapping the series behind, 1st marginal with alate internal expansion basally, with a slender process from outer distal corner, 2nd marginal stouter than the following *c.* 18 slender marginals, 2nd apically terete, the others biserrulate, the hindermost 2–3 elongate-obovate.

Fossil: Pleistocene; Algoa Bay (Johnson, 1904).

Kalk Bay (False Bay) (Krauss; coll. Wahlberg); Lüderitzbucht (Thiele); Table Bay (von Martens); Port Elizabeth (Sowerby); Port Alfred (Bartsch, Turton); East London (von Martens). Table Bay and False Bay to East London (S. Afr. Mus.).

Living: Table Bay (S. Afr. Mus.); False Bay, littoral to 17 fathoms (S. Afr. Mus. P.F. coll.; also U.C.T.).

Remarks. The central plate of the radula is relatively wider in the adult than in juveniles: the front margin about $1\frac{1}{2}$ times the combined width of 1st–4th lateral plates in the juvenile, at least twice as wide in adult.

Megatebennus (Cosmetalepas) africanus Tomlin

Fig. 21 c

Fissuridea concatenata (non Crosse & Fischer) Sowerby, 1892, p. 48; Smith, 1904, p. 25.

Lucafina concatenata (non Crosse & Fischer) Thiele, 1925, p. 41.

Megatebennus africanus Tomlin, 1926 a, p. 296, pl. 16, fig. 10.

Not saddle-shaped. Foramen about $\frac{1}{4}$ length of shell, in some shells slightly coarctate (see Tomlin's figure). The honeycomb pitting is very close and regular (quincuncial), the pits elongate-oval in the direction of the growth-lines on the sides, but subcircular at each end. White. Up to 20×15 mm., foramen 5.5×3.5 mm. Juveniles (coll. Muir) 1.3×1 mm., and 2×1.75 mm.

Animal (as preserved) with undulate mantle-edge, 23×20 mm., reflexed over the 15×12 mm. shell, leaving an opening 9×7 mm. around the foramen. Dull yellowish-brown, tentacles brown, eyes at base of tentacles, black (U.C.T.).

Radula with 55–60 rows, central plate oblique, about as broad as long, 5th lateral plate tricuspid, the external cusp more distal than the internal cusp, 1st marginal plate subtriangular, with *c.* 12 slender plates apparently attached to it, followed by *c.* 20 plates attached to the basal membrane of the radula, and overlapping the series behind, all apically biserrulate, the hindermost ones not obovate.

Port Elizabeth (Sowerby); Port Alfred (Smith, Tomlin, Turton). $35^{\circ} 26' S.$, $20^{\circ} 56' E.$, no depth given (Thiele). Still Bay (S. Afr. Mus. coll. Muir).

Living: $30^{\circ} 47' S.$, $30^{\circ} 27' E.$, 36 metres, 1 (U.C.T.).

Remarks. The very distinctive sculpturing seems to justify at least a subgeneric name (*Cosmetalepas* Iredale 1924, genotype *concatenata* C. & F.).

Of the distinctions between the Australian *concatenata* and the South African *africanus* given by Tomlin, the relative size of the foramen is not borne out by his figure: it is said to be one-fifth the length of the shell in *concatenata*, smaller in *africanus*, but the figure shows it larger ($\frac{1}{4}$). The sculpture is certainly very regular in South African shells, and as Tomlin was able to compare shells from both regions, the South African species can be maintained.

Thiele examined a radula but did not state definitely whether it was from an Australian animal or from the small corroded *Valdivia* shell. The radula of the present specimen—the only one hitherto taken alive in South African waters—agrees with that figured by Torr for the Australian *concatenata*, though I disagree with his interpretation of there being a double series of marginal plates (see *supra*, p. 284).

Diodora calyculata (Sow.)

Fissurella calyculata Sowerby, 1823, no. 21, fig. 4; Krauss, 1848, p. 68; Sowerby, 1862, p. 193, pl. 140 (err. 240), figs. 126, 127; von Martens, 1903, p. 55 (listed).

Fissuridea calyculata Sow., Bartsch, 1915, p. 177; Thiele, 1925, p. 40.

Diodora calyculata Sow., Tomlin, 1932, p. 160.

Up to 28 × 18, alt. 13 mm.

Knysna; St. Francis Bay; Still Bay (S. Afr. Mus.).

Sebastian Bay, low tide, 1; Algoa Bay, 33 fathoms, 4; East London, 20 fathoms, 1 (S. Afr. Mus. P.F. coll.).

The most westerly locality where this species has been found washed up on the beach is Cape Agulhas (Krauss). It does not seem to have been taken alive.

Diodora elizabethae (Smith)

Fissurella sieboldi (non Rve.) Sowerby, 1892, p. 47.

Glyphis elizabethae Smith, 1901, p. 104, pl. 1, fig. 12.

Fissuridea elizabethae Smith, Bartsch, 1915, p. 177.

Diodora elizabethae Smith, Tomlin, 1932, p. 160.

Not saddle-shaped, margin crenulate; foramen subcircular, hind margin squarish, internal callus truncate behind. Four strong nodulose ribs in front of and 4 behind the foramen; an additional smaller rib between the front pair and the hind pair, feeble in juv. at 4 mm. long (smallest seen), but distinct and noticeable (usually) at 10 mm. long. Up to 44 × 28 mm. High and low forms: 13 × 5, 13 × 4, 14 × 4, and 20 × 7, 20 × 6 mm.

Still Bay (S. Afr. Mus. coll. Muir); Port Elizabeth (Sowerby, Smith); Port Alfred (Bartsch, Turton); Tongaat (Natal) (S. Afr. Mus.).

Off Nieca River (East London area), 43 fathoms, 1 dead; off Tugela River (Natal), 47 fathoms, 1 dead (S. Afr. Mus. P.F. coll.).

Diodora spreta (Smith)

Fig. 22 g

Fissurella fimbriata (non Rve.) Sowerby, 1892, p. 48.

Glyphis spreta Smith, 1901, p. 104, pl. 1, fig. 18.

Fissuridea spreta Smith, Bartsch, 1915, p. 177.
Diodora spreta Smith, Tomlin, 1932, p. 160.

Not saddle-shaped, margin crenulate; larger shells tending to have sides concave and to rest on front and hind ends. Foramen subcircular, internal callus truncate behind. Usually 7 main radiating lirae in front of and 7 behind foramen, with 1 on either side (total 16), but 1 or 2 (3) intermediaries between each pair may become almost as strong as the main lirae, which may make the 16-lirate ribbing less conspicuous. Main growth-lines, 8–10 on large shells, well separated and forming squamose nodules on the lirae. Up to 27×18 , alt. 9 mm. Smallest seen 1×0.75 mm. The protoconch may persist or remain traceable as a tiny knob on shells up to 4 mm. long.

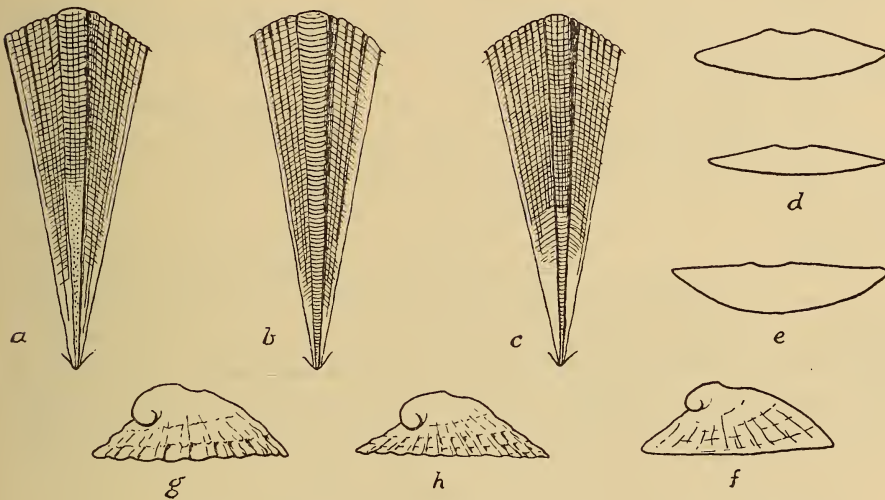


FIG. 22. *a, b, c*, *Tugalia barnardi* (Tomlin), anterior part of shell of Type (*a*) and two other specimens, to show variation in strength of lirae; *d*, *Amblychilepas scutella* (Gmelin) lateral profiles of high and low forms; *e*, the same, aberr. *sella* (Sow.); *f*, the same, juvenile 1.5×0.75 mm.; *g*, *Diodora spreta* (Smith) juvenile 1×0.7 mm.; *h*, *D. elevata* (Dnkr.) juvenile 2×1.3 mm.

Brown or fawn, more or less mottled, but seemingly never radially streaked. Mossel Bay (Smith; also S. Afr. Mus., cotypes); Still Bay (S. Afr. Mus. coll. Muir); Port Alfred (Bartsch, Turton).

Off Umhloti River and off Umkomaas River (Natal), 40 fathoms, 2 and 3 juv. dead (S. Afr. Mus. P.F. coll.).

Living: Still Bay, Breede River mouth and Bashee River mouth (U.C.T.).

Diodora elevata (Dnkr.)

Fig. 22 *h*

Fissurella elevata Dunker, 1846, p. 67, pl. 2, fig. 4; Krauss, 1848, p. 67; Sowerby, 1892, p. 47.

Fissurella fumata Watson, 1886, p. 34; Sowerby, 1892, p. 48.

Glyphis elevata Dnkr., Smith, 1901, p. 105; von Martens, 1903, pp. 55 and 57 note 17; Turton, 1932, p. 208.

? *Glyphis levicostata* Smith, 1914, p. 2, pl. 1, figs. 3-5.

Fissuridea elevata Dnkr., Thiele, 1925, p. 41.

Diodora elevata Dnkr., Tomlin, 1932, p. 160; Haughton, 1932, pp. 22, 43.

Glyphis anima Turton, 1932, p. 208, pl. 54, no. 1441.

Not saddle-shaped, margin crenulate; foramen subcircular, internal callus truncate behind. Radiating lirae moderate in early stages, numerous in later stages: *c.* 20-23 in shell 2 mm. long, 35 at 4 mm., 45 at 7 mm., *c.* 70 at 13 mm., *c.* 90 at 21 mm., and *c.* 100-114 in large shells, more or less subequal in strength, but a few slightly stronger than others; growth-lines distinct, forming a clathrate sculpture with the lirae, which are more or less squamosely nodulose at the intersections. Up to 30 × 21, alt. 11 mm. 35 × 23, alt. 14 mm. (Smith: *levicostata*).

Buff or brownish, often with a greenish tinge, uniform or with radiating darker brown, greenish or grey streaks, sometimes connected by 2 or 3 irregular concentric bands.

Fossil: Pleistocene, Angra Juntas, South West Africa (Haughton).

Port Elizabeth (Sowerby; also S. Afr. Mus.); Algoa Bay (von Martens); Port Alfred (Bartsch, Turton); Natal (Krauss; also S. Afr. Mus.). Still Bay (S. Afr. Mus. coll. Muir). Camps Bay (west coast of Cape Peninsula) (Watson).

Off Umhloti River (Natal), 40 fathoms, 3; off Cape Natal (Durban), 54 fathoms, 1; off Illovo (Natal), 27-30 fathoms, 1; off Cape Morgan, 47 fathoms, 1; off East London, 20 fathoms, 5; off Cove Rock (East London), 22 fathoms, 1; off Nanquas Peak (eastern end of Algoa Bay), 49 fathoms, 4; St. Francis Bay, 34 fathoms, 1; off Martha Point (Struys Bay), 42 fathoms, 3; False Bay, 23 and 32 fathoms, 3; Hoedjies Bay (Saldanha Bay), 2; all dead (S. Afr. Mus. P.F. coll.).

Living: False Bay, Mossel Bay and Algoa Bay (U.C.T.).

Tongaat and Port Shepstone (Natal) (Smith: *levicostata*).

Remarks. The statement by von Martens (1903, note 17) that *parviforata* Sow. 1889 was a synonym of *elevata* was corrected by Thiele (1925).

The juvenile is distinguished from that of *spretta* by the more numerous and more regular radiating lirae.

Smith's figure of *levicostata* surely represents an *elevata*. His description will fit *elevata*, except for the statement (in English comment) that the lirae are 'separated merely by impressed lines or striae', which applies better to *parviforata*. It is, however, contradicted in the next sentence by the words 'in the grooves between the riblets'.

Diodora australis (Krss.)

Fissurella australis Krauss, 1848, p. 67, pl. 4, fig. 10.

Glyphis fuscocremulata Smith, 1906a, p. 56, pl. 8, fig. 6; Turton, 1932, p. 208, pl. 54, no. 1442.

Fissuridea australis Krss., Bartsch, 1915, p. 177.

Diodora australis Krss., Tomlin, 1932, p. 160 (part: Scottburgh example).

Glyphis australis Krss., Turton, 1932, p. 208.

Not saddle-shaped, margin crenulate; foramen tilted forwards, subcircular, internal callus truncate behind, with a small pit. Radiating lirae *c.* 30, but with intermediaries which often may be nearly as strong as the main lirae, total *c.* 50–60, sharp, squamose where they are crossed by the less conspicuous concentric growth-lines. High and low forms: 15×11 , alt. 9.5 mm., 21×16 , alt. 14 mm. Krauss gave $8 \times 5.5 \times 4$ Paris lines = $18 \times 11.5 \times 8$ mm., but his figure of the side view measures long. 26, alt. 18 mm., and was thus drawn from a proportionately higher shell.

Port Alfred (Bartsch, Turton); Natal (Krauss); Port Shepstone, Umkomaas, and Tongaat (Smith); Scottburgh (Tomlin); Durban (S. Afr. Mus.).

Off Umhloti River (Natal), 40 fathoms, 1 dead (S. Afr. Mus. P.F. coll.).

Distribution. St. Paul and New Amsterdam (southern Indian Ocean) (Velain, von Martens (1903, p. 71)).

Remarks. I do not agree with Tomlin's identification of the Delagoa Bay shell (see *ruppellii*).

Smith (1910, p. 208) recorded a freak from Tongaat without an apical foramen.

Diodora crucifera (Pilsbry)

Fissurella cruciata (non Gould) Krauss, 1848, p. 67, pl. 4, fig. 9.

Fissurella crucifera Pilsbry, 1890, p. 225, pl. 32, figs. 27–31.

Diodora crucifera Pilsbry, Tomlin, 1932, p. 160; Janus, 1961, p. 2, pl. 1, figs. 1–3.

Not saddle-shaped, not very high, margin crenulate. Foramen not tilted forwards, suboval, internal callus not truncate behind, without pit. Radiating lirae *c.* 40–45, nodulose where crossed by the concentric growth-lines which are conspicuous, forming a cancellate sculpture. 23×16 , alt. 11 mm. (Krauss; but measurements of his figure long. 18, alt. 6 mm.).

Natal (Krauss); Tongaat (Natal) (Tomlin).

Lectotype in Stuttgart Museum.

Remarks. Seems to be distinct from *australis*, with well-marked cancellate sculpture (see Krauss's figure), and the lirae not squamose, or only slightly so near the margin.

The 3 worn Tongaat shells identified by Tomlin have more numerous lirae (main plus intermediary: 60–70) than Krauss gave for his species. The largest is 19×11.5 , alt. 6 mm.

Diodora ruppellii (Sow.)

Fissurella ruppellii Sowerby, 1835, p. 128.

Fissurella dysoni (non Rve) Braga, 1952, p. 93, pl. 6, fig. 9.

Diodora lima Sow., Macnae & Kalk, 1958, p. 127 (listed).

The following shells are evidently the same as that recorded from Delagoa Bay, by Braga: 2 from Delagoa Bay (S. Afr. Mus. A3620, coll. K. H. B.) identified and recorded by Tomlin (1932) as *australis*; 2 living from the same locality (U.W.); and 6 living from Inhambane (U.C.T.).

These have a keyhole-shaped foramen, not tilted forwards (slightly so in the high S. Afr. Mus. Shells), with internal callus not truncate behind and with no pit. The radiating lirae are very regularly arranged: 20–22 main lirae and 1 intermediary between each pair (total *c.* 45). Growth-lines well marked, forming nodules at intersections with the lirae, and a conspicuous cancellate sculpture (cf. *crucifera*).

The two U.W. shells from Delagoa Bay and the Inhambane shells are brown with 7–8 dark grey-brown radiating streaks.

The radulae of the U.W. and U.C.T. specimens have a squarish central plate, bicuspid 5th lateral plate, alate 1st marginal plate (as in *Pupillaea aperta*), and numerous marginals which overlap the series behind, the hindermost half-dozen obovate.

Remarks. Braga considered the occurrence of the Honduras species *dysoni* at Delagoa Bay as a 'salient' fact; as it undoubtedly would be if the identification were correct. Far more probably these specimens are referable to the Red Sea *ruppellii* (Sow.). They have 40–45 lirae which Smith (1901, p. 105) said distinguished *ruppellii* from *elevata*. The species occurs also at Mauritius and Madagascar.

Another possibility is the Indian *lima* (Sow.). But without material for comparison, I assign the present specimens provisionally to *ruppellii*.

Diodora parviforata (Sow.)

Fissurella parviforata Sowerby, 1839 a, p. 12, pl. 1, fig. 7; 1892, p. 48, pl. 2, figs. 52, 53; Haughton, 1932, pp. 30, 42.

Fissuridea parviforata Bartsch, 1915, p. 177; Thiele, 1925, p. 41 (correction to von Martens, 1903); Tomlin, 1932, p. 160.

Fissuridea algoensis Thiele, 1925, p. 40.

Glyphis parviforata Sow., Turton, 1932, p. 208.

Not saddle-shaped, margins crenulate. Foramen small, subcircular, internal callus truncate behind, with a deep pit. Radiating lirae numerous, more or less equal in strength on later part of shell, though some have evidently developed as intermediaries on the earlier part, separated by impressed striae or very narrow grooves, but relatively a little farther apart on early part of shell, lirae sometimes feebly regulose. Growth-lines distinct between the lirae on early part of shell, forming a cancellate sculpture, but indistinct on later part.

23 × 15, alt. 13 mm., 17 × 11, alt. 8 mm. (Sowerby; figure 53 measures long. 15, alt. 9.5 mm.). 11.5 × 7.5 × 4, 14 × 10.5 × 9, 14 × 10.5 × 9, 14 × 9.5 × 9, and 17 × 12 × 10 mm. (S. Afr. Mus.). In the 17 mm. shell the foramen measures 1 mm., and 2 mm. in the 23 mm. shell. White.

Radula with 60–70 rows, central plate squarish, 5th lateral plate bicuspid, 1st marginal plate triangular, alate, outer apical angle not produced in a slender process, marginals numerous, overlapping the series behind, hindermost half-dozen obovate.

Fossil: Pleistocene, Port Nolloth (Haughton).

Kommetjie (west coast of Cape Peninsula) (S. Afr. Mus.); Port Elizabeth (Sowerby; also S. Afr. Mus.); Port Alfred (Bartsch, Turton; also S. Afr. Mus.); Kalk Bay (False Bay) and Mossel Bay (Tomlin); Still Bay (S. Afr. Mus. coll. Muir).

Living: Langebaan (Saldanha Bay); Oudekraal (west coast of Cape Peninsula) (U.C.T.).

Distribution. St. Helena and Ascension Is. (Tomlin).

Remarks. Characterized by being at first sight lirate only, though closer examination shows the growth-lines on the early part of the shell. The lirae are very close together, Smith's words in connection with his *levicostata* being applicable here (see p. 292).

One specimen from Camps Bay (west coast of Cape Peninsula) and 12 others probably from the same locality, are quite white like *parviforata*. They range from 14×9 , alt. 6 mm. to $30 \times 20 \times 15$ mm. One of them is very narrow and high: $22 \times 13 \times 14$ mm., closely corresponding in form with the $14 \times 9.5 \times 9$ shell mentioned above.

In sculpture they do not seem to be quite typical; some of the lirae at the ends stand out a little more clearly as main lirae; and the cancellate sculpture continues, more or less clearly, to the margin in some of the larger shells. Some of them are not unlike *elevata*, and possibly the uniform white colour is due to bleaching.

The white coloration (farblos) seems to indicate that *algoensis* is a synonym; the sculpture fits that on the early part of *parviforata* shells.

Puncturella noachina (Linn.)

Puncturella noachina Watson, 1886, p. 42; von Martens, 1902, p. 243; Sowerby, 1903, p. 231; Thiele, 1925, p. 39; Powell, 1951, p. 86, fig. G 1 (radula).

Puncturella analoga von Martens, 1903, p. 70, pl. 5, fig. 8.

Off Table Bay, 125 fathoms (Sowerby; S. Afr. Mus. A3574, P.F. coll.).

Remarks. Long. 6.5, alt. 4.5 mm. No other specimens of this species have been found in searching through the *Pieter Faure* bottom samples. There is, however, the possibility or even probability that the specimen from Simon's Bay (False Bay), 70 metres, recorded by von Martens (1903, p. 50) as *fastigiata* A. Adams 1851, was a *noachina* though considerably higher: long. 5.5, alt. 5 mm.

P. noachina has been recorded from Kerguelen, Marion and Prince Edward Islands and the Straits of Magellan; and the southern examples seem indistinguishable from those of the northern Atlantic as regards shell characteristics, but the radulae may be different (see: Powell). Thiele pointed out that if another name is desirable for the southern shell, *analoga* von Martens must give place to the earlier *princeps* Mighels.

Puncturella africana Bartsch 1915 appears to be a juvenile *Emarginula*.

P. (Fissurisepta) agulhasae Clarke 1961 was recorded from 2,507 fathoms in the so-called 'Agulhas Basin', about 1,000 miles south-west of Cape Town.*

Gen. EMARGINULA Lam.

Thiele (1925) in claiming his *agulhasensis* to be the first record of the genus in South Africa overlooked Smith's record (1910, p. 209) of *micans* A. Adams. And Tomlin (1932) overlooked Thiele's record when he stated that Smith's record was the first 'and only' record.

Tomlin doubted whether Smith's Natal shell was *micans*, but did not suggest any other species. There are two shells, said to come from Natal, in the Ross-Frames collection which are different from any of the other species here described.

Emarginula agulhasensis Thiele

Fig. 23 a

Emarginula agulhasensis Thiele, 1925, p. 38, pl. 13 (1), fig. 1.

Apex not overhanging hind margin. Radiating lirae 25 (13 on left, 12 on right side) with 1 intermediary between each pair, and 4 between the 2 anterior main lirae, coarsely nodular where crossed by the growth-lines, of which 15 can be counted; the ridges forming the margins of the slit very thin, *c.* 10 concave pliculae corresponding with the growth-lines. 6.25×4 , alt. 2.4 mm. (Thiele). 8×5.5 , alt. 4 mm.

$35^{\circ} 16' S.$, $22^{\circ} 26' E.$, 155 metres (Thiele).

Off Cape Morgan, 77 fathoms, 1 dead (S. Afr. Mus. P.F. coll.).

Remarks. Although relatively higher, the present shell agrees with the *Valdivia* shell in the coarsely nodular lirae.

Emarginula pulchreclathrata Tomlin

Fig. 23 b

Emarginula pulchreclathrata Tomlin, 1932, p. 162, fig. 4.

Apex not overhanging hind margin. Radiating lirae *c.* 90, approximately every alternate one being slightly more prominent, all with small nodules where crossed by the growth-lines, of which *c.* 40 can be counted; the ridges forming the margins of the slit thin; *c.* 20 concave pliculae can be counted, not corresponding with the growth-lines; in the portion figured (about 8 mm.) there are 12 pliculae and 17-18 growth-lines. 19×12.5 mm. (Tomlin); alt. 9 mm.

Off Saldanha Bay, 55 fathoms (Tomlin; S. Afr. Mus. A3617, P.F. coll.).

Off Cape St. Blaize, 125 fathoms, 1 dead (S. Afr. Mus. A9324, P.F. coll.).

Type in the South African Museum.

Remarks. The Cape St. Blaize shell is a younger shell, 8.5 mm. long, agreeing with the Type in the number of lirae and growth-lines at the corresponding

* The basin south of the Agulhas Bank would be more correctly designated the Agulhas Basin. The naming of a species from *south-west* of Cape Town as *agulhasae* is misleading.

stage, and in the growth-lines being more numerous than the pliculae in the slit. The nodules on the lirae are slightly squamose towards the margin in the smaller shell, and the Type, though slightly corroded, shows similar traces.

Emarginula natalensis n.sp.

Fig. 23 c

Apex vertically over the hind margin, or very nearly (when not corroded). Radiating lirae *c.* 55-65, main and intermediary lirae alternating, feebly nodulose where crossed by the growth-lines, which are as strong as the lirae, forming a well-marked and regular clathrate sculpture; concave pliculae in the slit corresponding with the growth-lines. 7 × 5, alt. 3.5 mm. (Type); one of the Tugela River shells 8 × 5.25 × 4 mm.

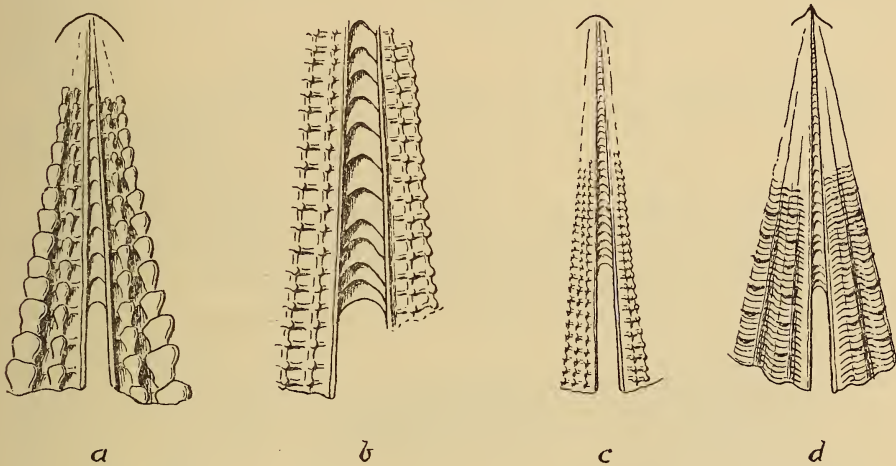


FIG. 23. Anterior part of shell of *Emarginula*: a, *agulhasensis* Thiele; b, *fulchreclathrata* Tomlin; c, *natalensis* n. sp.; d, *vadum* n. sp.

Off Cape Morgan, 77 fathoms, 3 (Types); off Tugela River (Natal), 65-80 fathoms, 2; off O'Neil Peak (Zululand), 90 fathoms, 1; off Cape Vidal (Zululand), 80-100 fathoms, 1; all dead (S. Afr. Mus. A9325 and A9326-A9328, P.F. coll.).

Remarks. The three Cape Morgan shells are the best-preserved and are therefore chosen as Types.

Emarginula vadum n.sp.

Figs. 23 d, 24 b

Apex extending slightly beyond hind margin. Radiating lirae 6 on each side, with 1 intermediary between each pair including the hindermost pair, and 1 between the foremost lira and the thin ridge bordering the slit; growth-lines very numerous and fine, crossing the lirae, on which they form at intervals

slight nodules; *c.* 14 can be counted on the foremost main lira; *c.* 24 concave pliculae can be counted in the slit, not corresponding with the growth-lines (nor with the nodules on the lirae). In lateral view the pliculae project slightly above the profile. 7×4.5 , alt. 3.5 mm.

Off Cape Vidal (Zululand), 80–100 fathoms, 1 dead, fresh (S. Afr. Mus. A9329, P.F. coll.).

Remarks. The fine growth-line sculpture resembles the ripples in shallow water at a ford. Quite unlike any of the other South African species.

E. undulata Melvill & Standen (1903, p. 290, pl. 20, fig. 1), from the Gulf of Oman, appears to have similar close-set growth-lines, but differs in having more radiating ribs.

Emarginula oppressa n.sp.

Fig. 24 a

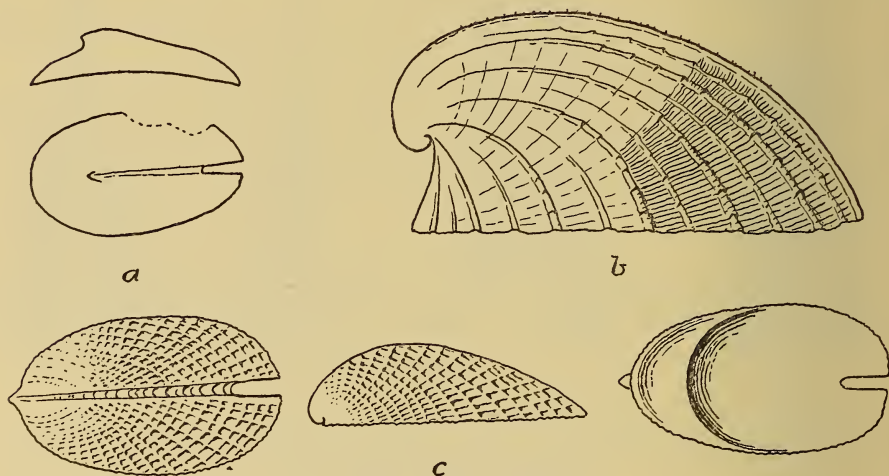


FIG. 24. *a*, Profile and outline of *Emarginula oppressa* n. sp. *b*, *E. vadum* n. sp. (growth-lines not completely drawn); *c*, *Zaidora reticulata* A. Adams, dorsal, lateral, and ventral views.

Depressed, scutiform, apex at about $\frac{2}{7}$ length from hind margin, sides somewhat concave, shell resting on front and hind ends. Radiating lirae *c.* 50, main and intermediary lirae alternating, but all nearly of the same strength, at least near the margin, squamulose-nodulose where crossed by the growth-lines which are not so strong as the lirae but form a well-marked and regular clathrate sculpture; concave pliculae in the slit corresponding with the growth-lines. 14×9 , alt. 3 mm.

Off Cape Natal (Durban), 54 fathoms, 1 dead (S. Afr. Mus. A9330, P.F. coll.).

Remarks. The specimen is slightly damaged on one side, but otherwise is in good condition.

Zeidora reticulata A. Adams

Fig. 24 c

Zeidora reticulata A. Adams, Thiele, 1929, p. 32, fig. 17.

In the two Tugela shells: Radiating lirae *c.* 20, but the posterior ones indistinct, here and there an intermediary; growth-lines *c.* 20, but the posterior ones indistinct, as strong as the lirae, forming with them a clathrate sculpture; concave pliculae in the slit nearly corresponding with the growth-lines, but occasionally an extra one. Septum about $\frac{1}{4}$ length of shell.

In the Sandy Point shell, which is larger than the Tugela shells, radiating lirae *c.* 30, and about the same number of growth-lines, but anteriorly the latter are closer together and not so regularly spaced as on the earlier part of the shell; convex pliculae in the slit more numerous than the growth-lines, especially anteriorly. 4.75×2.75 , alt. 1.25 mm. (Tugela); 7×3.5 , alt. 2 mm. (Sandy Point).

Off Tugela River (Natal), 65–80 fathoms, 2 dead, fresh; off Sandy Point (north of Kei River mouth), 51 fathoms, 1 dead, fresh (S. Afr. Mus. A9331, A9345, P.F. coll.).

Distribution. Japan.

Remarks. This may be the Japanese *reticulata*, but the figure in Sowerby (1863, pl. 245, fig. 3) is too small for a comparison. Thiele's figure shows (not very clearly) approximately the same number of lirae and growth-lines as the present specimens. The septum is too well developed for the Red Sea *Z. (Nesta) candida* H. Adams.

There is no great improbability in the Natal specimens being conspecific with the Japanese species, and I record them as such pending the opportunity of a direct comparison.

Gen. TUGALIA Gray

Thiele, 1929, p. 33; Tomlin, 1932, p. 163; Powell, 1951, p. 87.

Thiele did not mention *Parmaphorella* Strebel 1907, even as a synonym, and accepted *Tugalia* Gray 1857 with a dozen species in the Indo-Pacific and Falkland Islands. Powell accepted *Parmaphorella* with 2 subantarctic species and the South African species.

The characters given by Tomlin to differentiate *Parmaphorella* from *Tugalia* do not seem very decisive. In *P. melvilli* (Thiele) he said the 'rib' [i.e. the external ridge corresponding with the internal anal groove] is 'twice the breadth of the others' [= radiating lirae]; but in *Tugalia* there is 'no alteration of sculpture to mark the anal rib'. In all the unworn present specimens (except one) there is a ridge from the apex 'regularly crossed by the concentric striae' in shells up to about 6–7 mm. long; thereafter the ridge is ornamented with 2–4 (5) lirae subequal in strength to the other lirae. In other words, the shell seems to be a *Parmaphorella* when young, and a *Tugalia* in later life. This liration

on the ridge is seen in both the Type and the broken specimen recorded by Tomlin.

The exception (from East London, S. Afr. Mus. A3624) shows a broad ridge unmarked by any lirae and crossed throughout its length (13 mm. long) by the concentric growth-lines.

The acceptance of *Tugalia* avoids the paradoxical situation, as Tomlin expressed it, of the rejection of a name *ipso facto* constituting publication of that name.

Tugalia barnardi (Tomlin)

Figs. 21 *d*, 22 *a-c*

Emarginula (*Tugalia*) *carinata* A. Adams, Thiele, 1925, p. 39.

Parmaphorella barnardi Tomlin, 1932, p. 164, fig. 5.

Internal groove and external ridge distinct on early part of shell, usually traceable on later part but sometimes indistinct. Radiating lirae over whole shell, for the most part subequal in strength, but variable, broader and narrower ones alternating, or 2-3 narrow ones between a pair of broader ones; on posterior part of shell the lirae tend to be stronger. Concentric growth-lines with a slight notch where they cross the external ridge, less well marked towards the margin in older shells, usually stronger than the lirae, and more or less nodulose at the intersections (when not worn). Up to 24 × 16, alt. 10 mm. Type: 19 × 12, alt. 7 mm.

Cream-coloured or greyish-white.

Animal white, mantle edge with black spots (U.C.T.).

Radula with *c.* 55 rows, central plate oblique, slightly longer than broad, front margin scarcely turned-over, 1st-4th lateral plates narrow, with small overturned apices, 5th lateral strong, with long uncinatate cusp and small external cusp, 1st marginal plate narrow-oval, closely adjacent to the first 7 or 8 of the numerous slender plates, which posteriorly overlap the series behind, hindermost 4-6 elongate-obovate, spatulate.

35° 16' S., 22° 26' E., 155 metres; 34° 51' S., 19° 37' E., 80 metres (Thiele: *carinata*).

Cape Point N. 50° E., distant 18 miles, 180 fathoms, 1 living, 1 dead (Tomlin: P.F. coll.). Off Cape Morgan, 77 fathoms, 1 and 3 juv. dead; off Cove Rock (East London), 80-130 fathoms, 1 dead (the largest shell); 33° 5' S., 25° 54' E., 33 fathoms, 1 dead; off Martha Point (Struys Bay), 42 fathoms, 2 dead; False Bay, 9 fathoms, 2 living; Lion's Head (Cape Town) N. 67° E., distant 25 miles, 131-136 fathoms, 1 dead (S. Afr. Mus. P.F. coll.).

34° 15' S., 25° 5' E., 6 fathoms, 1 living (U.C.T.).

Cape Peninsula, on beach, 1 dead (S. Afr. Mus.).

The distribution is thus from Cape Morgan to Cape Point and off the west coast of the Cape Peninsula.

Type and cotype in the South African Museum (A3623).

Remarks. Tomlin's statement that the apical beak 'almost overhangs the

margin' is true only of juveniles; in adults, as the figure shows, the apex lies well within the margin.

Tomlin naturally assumed that as one of the two shells sent to him was broken, the other (Type) was also a dead shell; inadvertently he was not told that the animal of the Type was retained at the South African Museum. Both shells have a somewhat worn aspect, which frequently occurs in shells from deep water in the Cape Point area.

Although this species has been taken alive in 9 fathoms in False Bay, and 6 fathoms in Algoa Bay (U.C.T.), only one specimen has been found washed up on the beach, doubtless owing to its fragility.

Unfortunately Tomlin did not refer to Thiele's record of the Philippine *carinata*, or compare the South African shells with any other Indo-Pacific species.

That the *Valdivia* and *Pieter Faure* shells are conspecific can scarcely be doubted; and Thiele's identification will probably prove to be correct. No certain identification can be obtained from the descriptions and figures in Sowerby (1863); actual material is needed, and when such is available due regard must be paid to small individual variations in the sculpture, which are not specific characters as is shown by the present material.

Scutum unguis (Linn.)

Parmaphorus imbricatus Krauss, 1848, p. 62.

Scutus unguis Linn., Smith, 1879, p. 261; 1903, p. 391; Bergh, 1905, pl. 3, fig. 20; Bergh in Schepman, 1908, p. 99; Macnae & Kalk, 1958, p. 127 (listed).

Natal (Krauss); Durban (Smith); Delagoa Bay (Macnae & Kalk).

Umpangazi (Zululand), Port Edward, and Port St. Johns (U.C.T.).

Off Cape Morgan, 77 fathoms, posterior half of a broken juvenile specimen, 3 mm. wide (S. Afr. Mus. P.F. coll.).

Remarks. This juvenile is not a *Cocculina*; comparison with the apical part of a large specimen shows the beginning of the laminated surface characteristic of *Scutum*.

Fam. **Scissurellidae**

Scissurella smithi Thiele

Scissurella jucunda (non Smith 1890) Smith, 1910, p. 207, pl. 8, figs. 2, 2a; Bartsch, 1915, p. 175.

Scissurella smithi Thiele, 1912b, p. 7; 1925, p. 42; Tomlin, 1926a, p. 296 (attributed to Kobelt).

Port Elizabeth (Smith); Port Alfred (Bartsch, Turton); Still Bay (S. Afr. Mus. coll. Muir).

Scissurella agulhasensis Thiele

Scissurella agulhasensis Thiele, 1925, p. 41, pl. 13 (1), fig. 2.

On last whorl above the slit *c.* 70–75 axial pliculae.

35° 16' S., 22° 26' E., 155 metres, 3 (Thiele).

Off Hood Point (East London), 49 fathoms, 1; 34° 26' S., 25° 42' E., 124 fathoms, 4; off Cape St. Blaize, 125 fathoms, 1; all dead (S. Afr. Mus. P.F. coll.).

Schismope insignis Smith

Schismope insignis Smith, 1910, p. 208, pl. 8, figs. 4, 4a; Bartsch, 1915, p. 176.

Turton (1932, p. 204) gave the size as 2 mm. The largest shell in the Muir collection is alt. 0.8, diam. 1 mm. Smith gave 0.5 × 0.8 mm.

Port Elizabeth (Smith); Port Alfred (Bartsch, Turton); Still Bay (S. Afr. Mus. Muir coll.).

Fam. **Haliotidae**

Thiele, 1929, p. 28; Lissmann, 1945, pp. 58-69, graphs, pl. 1 (locomotion).

According to Lissmann's diagrams the rate of progression of the European *H. tuberculata* seems to be 1-2 cm. per second.

Haliotis midae Linn.

Figs. 25 a-c, 26

Haliotis capensis Dunker, 1844, p. 120, pl. 1, figs. 4, 5.

Haliotis midae Linn., Krauss, 1848, p. 93; Turton, 1932, p. 202.

Haliotis elatior Pilsbry, 1890.

Haliotis midae elatior, and *midae capensis*, Turton, 1932, p. 203.

Protoconch nucleus plus about $\frac{3}{4}$ of a whorl 1.5 × 1 mm., smooth; followed by fine and regular spiral lirae 6-8 above the foramina, 5-6 between these and the periphery, 3-4 between latter and edge of columellar plate; increasing to respectively 25-30, 9-10, and 4 at 12 mm. diam.; 50-60, 10-12, and 6-8 at 40 mm. diam.; thereafter the lirae obscured on upper surface by oblique corrugations, which develop at first in middle of whorl, then extend across whole whorl from suture to the foramina; the corrugations usually begin at 40 mm. diam., but may begin at 35 mm., or occasionally at 30 mm. diam.



FIG. 25. *Haliotis*: a, radula plates of *midae* Linn.; b, protoconch nucleus plus 1st whorl of *midae*; c, juvenile of *midae*, 4.5 × 3.5 mm.; d, protoconch nucleus plus 1st whorl of *parvum* Linn.

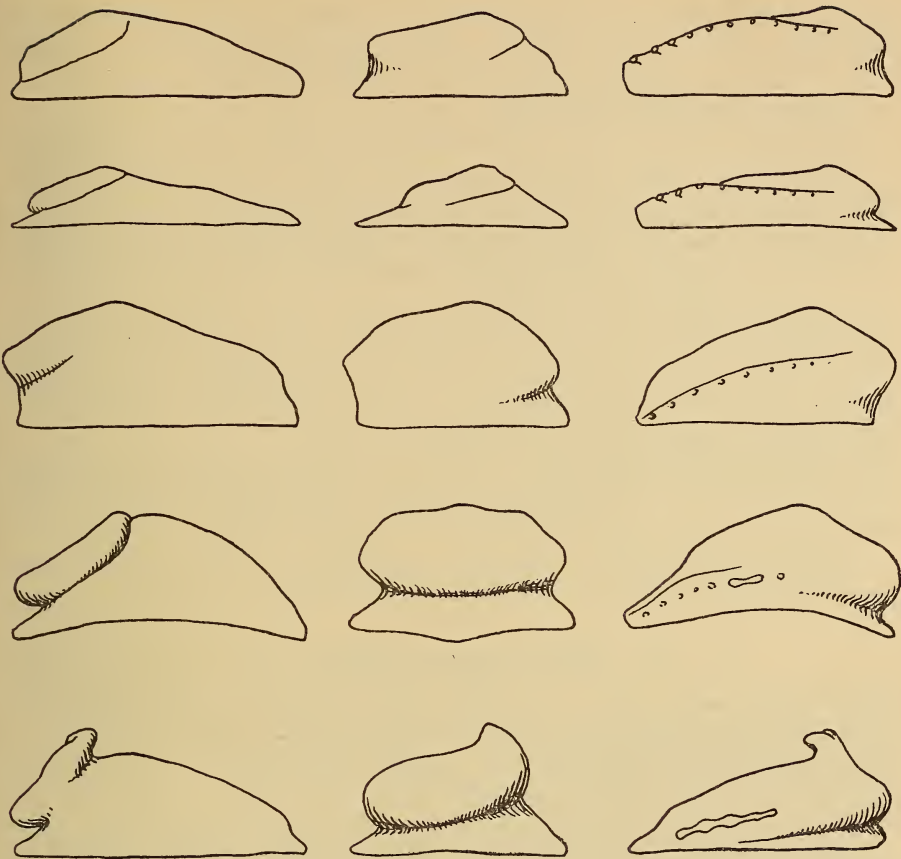


FIG. 26. *Haliotis midae* Linn., views from apertural side, apical end, and columella side: normal, low form, high form (*elator*), and two freak individuals. All approximately 150×130 mm.

Periphery never sharply marked, and after about 40 mm. diam. the profile between the foramina and the columellar plate is evenly rounded; in large shells it may be concave, with the columellar plate projecting like a flange.

Up to 188 maj. \times 177 min. diam., alt. at apex 72 mm.; also 181 maj. \times 152 \times 53 mm.; also 175 \times 156 \times 58 mm. (f. *elator*), and 170 \times 140 \times 45 mm. Krauss gave $7\frac{1}{2} \times 6\frac{1}{2} \times 2\frac{1}{2}$ inches.

Young shells brown, rusty-red, or maroon, the lirae (at least in very young) paler than the interstices. Protoconch and most of 1st whorl pale.

Radula with *c.* 60 rows in a shell 25 mm. long, central plate broader than long, laterally indented, with strong but entire cutting-edge, 1st lateral plate wider than central plate, with entire cutting-edge, 2nd lateral longer than wide, 3rd-5th laterals stout, with strong unciniate cusp, the 3rd plate the largest, marginal plates numerous, with unciniate serrate apices, inner ones not

much longer than 5th lateral plate, longer and more slender in the middle of the series, outermost ones widening distally, with slight overturned truncate apex, the last one usually obovate and incompletely divided.

Fossil: Pleistocene, Algoa Bay.

Saldanha Bay, Table Bay, False Bay to Port Alfred (*auct. et S. Afr. Mus.*).

Remarks. As Krauss showed, *capensis* is merely a growth-stage of *midæ*. The name *elatiior* was given to unusually high individuals; such forms are reported to be of more frequent occurrence at Saldanha Bay than elsewhere.

Very large shells occur in the kitchen-middens at Cape Hangklip, but no actual measurements are available.

Owing to injuries, intrusion of foreign bodies between the mantle and the shell, and lesions by the boring sponge *Cliona*, various reparations to the internal surface occur such as baroque nacreous pustules and concretions, and more or less extensive duplication of the columellar plate.

The muscle scar is traceable, chiefly by a faint but not conspicuous line on the left side, up to about 90–100 mm. shell maj. diam.; but thereafter the scar becomes more or less roughened, with a clearly defined outline.

Although young shells are common at Still Bay, Dr. Muir obtained only 1 as small as 4.5×3.5 mm., and only 1 protoconch plus 1st whorl.

Haliotis sanguineum Hanley

Haliotis sanguineus Hanley, 1841, p. 60, frontispiece, fig. 5; Krauss, 1848, p. 94; Bartsch, 1915, p. 174; Turton, 1932, p. 203; Macpherson, 1953, p. 169, pl. 1.

Haliotis ficiformis Menke, 1844, p. 98.

Haliotis pertusa (non Rve.) Bartsch, 1915, p. 175; Turton, 1932, p. 203.

Haliotis nebulata (non Rve.) Turton, 1932, p. 203.

Protoconch nucleus plus about $\frac{3}{4}$ whorl 1.5×1 mm., smooth; followed by spiral liræ 2 above the foramina, 2 below, and 1 below the periphery; increasing to respectively 10–12, 3, and 2 at 12 mm. diam., *c.* 18, 4 (5), and 2–3 (4) at 25 mm.; at 35 mm. diam. the liræ on the upper part of whorl evanescent. Between the foramina and edge of columellar plate 6–7, a peripheral lira not distinguishable from the others; on the upper part the original 2–4 liræ more or less bluntly nodulose or pustulose; in large shells the liræ evanescent and surface smooth.

Growth-lines fine and close, at intervals (periodic cessation of growth) rather more prominent. In some shells (not under 30 mm. maj. diam.) undulations may occur protractively oblique to the growth-lines, but never as strong as the corrugations in *midæ*.

Up to 76×48 , alt. 26 mm., $81 \times 50 \times 23$, and $86 \times 54 \times 30$ mm.

Fulvous, brown, or greenish-brown, usually with pale streaks and vermiculations in young shells, old shells uniform red-brown or maroon; the pustules on the liræ usually green or the liræ articulated with green and red; usually an orange-red suffusion internally at apex.

Radula plates as in *midæ*.

Table Bay and False Bay to Port Alfred (*auct. et S. Afr. Mus.*). Durban and Tongaat (Natal) (S. Afr. Mus.).

Distribution. Mauritius, and West Australia (Macpherson).

Remarks. Dr. Muir did not obtain at Still Bay any juveniles under 14 mm. maj. diam.

Usually when a shell is laid on a flat surface the apex is the highest point, and the profile between apex and the foramina is slightly concave. Some examples, however, have a convex profile and the highest point is about in the middle of the shell, e.g. the 86 mm. shell recorded above.

Some shells with strong undulations resemble at first sight *midae*, but the few and well-separated lirae between the foramina and the columellar edge are distinctive of *sanguineum*.

The muscle scar does not become roughened, even in the largest shells.

The occurrence of living examples on the coast of West Australia (33° 53' S.) is interesting. Macpherson compared them with Cape specimens, and also a Mauritius example, and found no differences.*

Haliotis parvum Linn.

Fig. 25 d

Haliotis parvum Krauss, 1848, p. 94; Smith, 1910, p. 207; Turton, 1932, p. 203.

Haliotis kraussi Turton, 1932, p. 203, pl. 53, no. 1413.

Protoconch nucleus plus about $\frac{3}{4}$ whorl 1.5 × 1.25 mm., smooth; followed by spiral lirae *c.* 15 above the foramina, 5 between these and periphery, 2-3 between latter and columellar plate; increasing to respectively 20-25, 6-7, and 3-4 at 10 mm. diam.; at 40 mm. diam. to respectively *c.* 60, *c.* 12, and 8-10. The peripheral lira is slightly larger than the others and more or less carinate; but after about 15 mm. diam. while continuing to be slightly larger ceases to be peripheral, and in large shells there is no distinction between the sub-foraminal and basal zones.

The midwhorl ridge begins at the same time as the spiral lira and the foramina, but sometimes is not very conspicuous. In large shells it tends to become flatter and may sometimes be almost obsolete. Growth-lines on early part of shell often producing a fine cancellation.

Up to 45 maj. × 34 min. diam. Turton gave 47 mm.

Sometimes nearly uniform pale brown, but usually variously mottled with rusty-red or maroon patches on a pale ground-colour; beach shells often more brightly coloured, sometimes uniform orange.

Radula plates as in *midae*, in a shell 20 mm. long *c.* 50 rows.

Table Bay (Krauss, Sowerby); False Bay (Bartsch; coll. Stimpson; also

* A paper by Shirley, 'Marine Mollusca common to Australia and South Africa' (*Proc. Roy. Soc. Queensland*, xxxi, 1919, pp. 83-89), cannot be taken seriously. Only old authors were consulted, the latest being Bartsch (1915). 'Shell names common to . . .' would have been a more accurate title.

S. Afr. Mus.); Still Bay (S. Afr. Mus. coll. Muir); Port Elizabeth (Sowerby); Port Alfred (Bartsch, Turton).

Living: False Bay, 6-14 fathoms (S. Afr. Mus. P.F. coll.; also U.C.T.).

Remarks. In the Muir series are shells from 6.5 mm. up to 45 mm. maj. diam.; also a protoconch plus the smooth whorl which shows the beginnings of the spiral lirae (only just visible) and the mid-whorl ridge, and 3-4 white dots on a slight ridge but no open foramen.

Haliotis speciosum Rve.

Haliotis speciosum Reeve, 1846, sp. 47; Talmadge, 1958, p. 278.

Haliotis pertusa (non Rve.) Sowerby, 1900, p. 6; Smith, 1903, p. 391.

Haliotis alfredensis Bartsch, 1915, p. 175, pl. 24, figs. 7, 8; Tomlin, 1927, p. 81; Turton, 1932, p. 203.

Spiral lirae at start 10 between suture and foramina, 4 between these and periphery, increasing at 17 mm. to *c.* 40-45, 7-8, and 4-5 below periphery; at 45 mm. *c.* 60, 10, and 6-7 respectively, the latter somewhat irregular and the periphery blunt and obsolescent.

A very faint midwhorl ridge with a very shallow groove above it can sometimes be seen in profile, or better by oblique lighting on the internal surface.

Growth-lines on early part of shell forming a more or less distinct fine cancellation, but with the lirae predominating.

55 maj. diam. \times 39.5 mm. min. diam. (Bartsch). 'About 2½ inches' (Talmadge).

Mottled or blotched with rusty-red or maroon on a pale cream or brown ground-colour.

Pondoland = Kowie = Port Alfred (Sowerby, Bartsch, Turton, Talmadge; also S. Afr. Mus.). Natal (Talmadge: *ex* Natal Mus.).

Remarks. Tomlin (1926a, p. 296) doubted Bartsch's identification of Stimpson's False Bay examples as *pertusa*. They are almost certainly *sanguineum*, and as such are recorded above.

Talmadge, by sending a Pondoland specimen to the British Museum to be compared with the Type series of *speciosa*, and then to the U.S. National Museum for comparison with the Type of *alfredensis*, seems to have satisfactorily established the correct name for this species.

Haliotis queketti Smith

Haliotis queketti Smith, 1910, p. 206, pl. 8, figs. 1, 1a; Turton, 1932, p. 203; Macnae & Kalk, 1958, p. 127 (listed) (*queketti* [*sic*]).

Spiral lirae between suture and foramina 7-8 at about the beginning of 2nd whorl (prior to that indistinct from wear), increasing to *c.* 32-35 at aperture, 2 between foramina and peripheral lira, increasing to 6-7 (8), and 3-4 (5) below the latter (exposed on the last whorl); all lirae squamose; peripheral lira distinct, but flattened near the aperture.

Midwhorl ridge feeble and only slightly raised, even the corresponding groove on internal surface often obscure. Faint oblique undulations sometimes present. Foramina prominently raised.

Up to 46 maj. \times 32 mm. min. diam.

Pale brown or reddish, with darker maroon or brown blotches, and more or less distinct radiating streaks near suture, margin below foramina with alternating olivaceous-brown or red-brown and pale bars.

Isezela (Natal) (Smith). Port Alfred (Turton). Natal (S. Afr. Mus. *ex* coll. Ross-Frames). Delagoa Bay (Macnae & Kalk).

Off O'Neil Peak (Zululand), 90 fathoms, 1 (S. Afr. Mus. P.F. coll.).

Remarks. Smith gave the number of spiral striae as about 12; if counted along the minor diameter this number corresponds with his figure; but the latter shows at least 16 at the apertural margin. In the two present specimens there are at least 16 along the minor diameter and double that number at the margin.

One of the specimens is strongly liriate; the other almost smooth, except close up under the suture, up to about 40 mm. maj. diam., ending with a well-marked line indicating temporary cessation of growth; the later addition to the shell is more normally liriate. The area below the foramina is strongly liriate (normal) throughout, but shows the line of cessation.

The *Pieter Faure* specimen is young (*c.* 22 mm. maj. diam.) and almost completely covered with coralline growth; but the prominence of the foramina indicates its specific identity.

Haliotis bistriata Gmelin

Three specimens, identified by J. H. Ponsonby, presented by E. L. Layard, registered as from 'South Africa'. This species has been recorded from Mozambique, and probably these specimens were obtained by Layard when he accompanied H.M.S. *Castor* up the East Coast of Africa. The South African Museum has it also from Mauritius (coll. R. F. Lawrence, 1935).

A specimen recently obtained from Bazarute Island is very similar, but the spiral lirae are much finer than the coarse lirae, in places somewhat nodulose, typical of *bistriata*. The lirae below the foramina, however, agree with those of *bistriata*: 4-5 followed by 3 stronger ones.

Fam. **Pleurotomariidae**

Pleurotomaria africana Tomlin

Pleurotomaria quoyana (non F. & B.), Fish. Mar. Biol. Surv., 1933, pp. 20-23, fig. of Durban Museum specimen.

Pleurotomaria africana Tomlin, 1948, p. 2, pl. 1; Barnard, 1963*c*, p. 156, fig. 2.

[*Non*] *Pleurotomaria* [*sic*] (err. *pro* *Pleurotoma*) Wybergh, 1920, p. 66.

The first specimen was taken by the Fisheries Survey vessel *Africana* on

21st July 1931, at 29° 50' S., 31° 19' E., in 369 metres. It measured alt. 118, diam. 115 mm., and was presented to the Durban Museum.*

The second specimen was taken on 27th June 1932, at 29° 48' S., 31° 23' E., in 366 metres. It was presented to the South African Museum, and was later described by Tomlin, thereby becoming the Type of the species. Alt. 83, diam. 100 mm.

In 1948 three more specimens were obtained by the *Africana*, one of which went to the Transvaal Museum, Pretoria, and the other two to America.

The South African Museum has an operculum which was also presented by the Fisheries Survey, but which probably belonged to a larger shell than the Type, having max. diam. 29 mm. (*vide infra*).

So far as I am aware none of the animals taken by the *Africana* were preserved.

A specimen obtained by a deep-sea trawler has been presented, I am informed, to the British Museum.

Thanks to the kindness of Mrs. H. Boswell of Pretoria, I have recently (1963c) examined two fine specimens, both larger than the Type, and both containing the animal with operculum: alt. 104, diam. 125 mm., and alt. 123, diam. 145 mm.

Tomlin assigned two unsculptured whorls to the protoconch in the Type; this seems to be correct, though the surface is worn and polished. The present 125 mm. shell has 9 whorls, but on the upper two most of the sculpture has been abraded. On the 145 mm. shell the protoconch and (?) 1st whorl are worn away; the diameter of the uppermost remaining whorl corresponds with that of the 2nd postnatal whorl of the Type; on this reckoning there would be 10 postnatal whorls on this large and seemingly fully-grown shell.

The slot in the Type is not more than $1\frac{3}{4}$ inches long; in the 145 mm. shell it is 7-8 mm. wide and $2\frac{1}{2}$ inches long.

A spiral lira in the middle of the cicatrix in the slot begins (as a series of tiny granules, one on each growth-line) on the 4th whorl; a second one below it begins on early part of 6th whorl, and a third one (above the original one) on later part of 6th whorl; on last there are 4 lirae (as Tomlin said) but they are not continuously distinct. In the 145-mm. shell the 4 lirae are obscured towards the aperture by the growth-lines becoming very coarse.

The spiral lirae between the slot and the suture below increase from 1 on 2nd whorl to 11 on last whorl; those between slot and the suture above

* These measurements seem to be anomalous in that the altitude exceeds the diameter, though only slightly. In other specimens the diameter exceeds the altitude. At my request Mr. P. Elston of Durban measured the specimen in the Durban Museum, and found alt. 102, diam. 110 mm. Scarcely any two people will obtain the same results in the measurement of a shell (cf. Connolly, 1939, p. 3), and the discrepancy need not be very seriously considered. Nevertheless there may be a doubt whether the specimen now in the Durban Museum is the same as that referred to in the Fisheries and Marine Biological Survey Report, because (so Mr. Elston informs me) the present specimen bears a label: 'Dept. of Geology.'

increase from 2 on 2nd whorl to about 25, with some fine intermediaries, on last whorl.

The operculum of the 125-mm. shell has max. diam. 28 mm. It corresponds with Dall's figure of that of *adansoniana* (1889, pl. 32, fig. 10). Seven or eight whorls can be counted, but the earliest whorls in the centre are indistinct.


The coarseness of the growth-lines towards the aperture, especially those filling up the slot, together with the broken and worn operculum, in the 145 mm. shell seem to indicate that this is about the maximum size to which the species grows.

Animal in general resembling *adansoniana* (Dall, 1889, p. 401). Sole longitudinally irregularly pleated. Foot dorsally behind the operculigerous lobe with a deep medio-longitudinal groove to end of foot, transversely rugulose and with a row of papillose warts on either side of the deeper part of the groove. Epipodia without cirri or processes; the left extending forwards to the operculigerous lobe, the right to the front of the foot.

Mantle edge papillose. Rachis of each gill anteriorly free and sharply pointed. Vascular area on dorsal part of mantle well developed, reddish in colour (after preservation). Rectum not free from mantle distally; containing an amorphous mass with a few minute Foraminifera, not consolidated into faecal pellets. According to Thiele (1935, p. 1129) the species of *Pleurotomaria* seem to feed chiefly on sponges.

Jaw plates subcircular; very feebly attached (as preserved).

Radula similar to that of *adansoniana* (Dall, 1889, p. 402, pl. 31, figs. 3-6). The description of the radula of *hirasei* is not available.

Ribbon very long: 90 mm., with at least 170 rows. In cross-section -shaped, the central tooth with its 4 flanking laterals on each side form a median ridge at the bottom of the groove formed by the arching-over of the fan-like groups of marginal teeth on either side (see Barnard, 1963c, fig. 2).

The 4 laterals flanking the central tooth are stronger and slightly larger than the following laterals, of which there are about 25, at first decreasing in size, then increasing and gradually passing into the strong, uncinately curved teeth with simple acute apices, of which there are about a dozen. These gradually change into marginals with 1 subapical denticle, and then with 2 denticles; these are succeeded by at least 50 slender marginals with 2 subapical denticles and a tuft of bristles; the outermost half-dozen marginals are narrow lamellae with simple subtruncate apices. There is no sharp distinction between laterals and marginals; most of the latter have the peculiar apical tufts, of which in *adansoniana* there are only five (Dall).

The South African species apparently belongs to the subgen. *Mikadotrochus*, which has no umbilicus and has the columella margin thickened and twisted (Lindholm, 1927, not seen). It has been compared with the Japanese species *teramachii* Kuroda 1955.

Fam. *Acmaeidae**Acmaea roseoradiata* Smith

Fig. 27 a

Acmaea roseoradiata Smith, 1901, p. 106, pl. 1, fig. 19; Thiele, 1925, p. 38.

Described from Cape Town. The South African Museum has a large number of dead shells *ex coll.* J. Juritz, a resident of Cape Town, but without locality label. Up to 6 × 5 mm.; Smith: 5.75 × 4.5 mm.

35° 16' S., 22° 26' E., 155 metres (Thiele).

U.C.T. obtained living examples in Simon's Bay (False Bay) at 2½–17 metres.

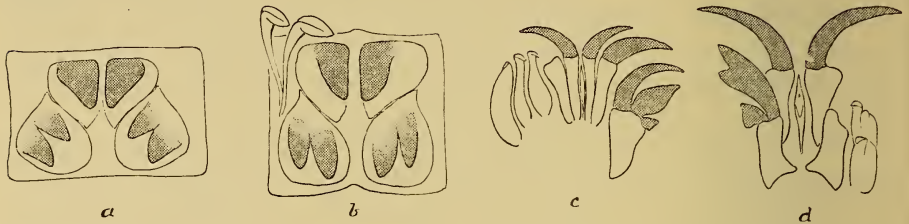


FIG. 27. Radula plates of: a, *Acmaea roseoradiata* Smith; b, *Patelloida profunda* (Desh.); c, *Helcion pectunculus* (Gmelin) 3rd lateral plate and indurated cusp of 2nd lateral removed on left side; d, *Cellana capensis* (Gmelin), indurated cusp of 2nd right lateral plate removed.

Radula with *c.* 45 rows, no central plate, 2 lateral plates, one behind the other, with retrorse cusps, that of the hinder plate bifid, the three cusps forming an oblique line on each side, no marginal plates.

Remarks. The New Zealand *roseoradiata* Suter 1907 was renamed *suteri* by Iredale, 1915.

Patelloida profunda (Desh.)

Fig. 27 b

? *Patelloida conoidea* Q. & G., Krauss, 1848, p. 57.

Patella profunda Deshayes, 1863, p. 44, pl. 6, figs. 15, 16; von Martens, 1880, p. 299; Tomlin & Stephenson, 1942, p. 6; Stephenson, 1948, pp. 279, 282; Day & Morgans, 1956, p. 306 (listed).

Helcioniscus profundus Desh., Pilsbry, 1891, p. 150, pl. 65, figs. 94–96, and var. *mauritanus*, figs. 97–99; Dautzenberg, 1929, p. 551.

Acmaea albonotata Smith, 1901, p. 107, pl. 1, figs. 14, 16.

? *Acmaea coppingeri* (*non* Smith) Turton, 1932, p. 160, pl. 36, no. 1141.

Patelloida profunda (Desh.) Hodgkin, 1962, p. 5, fig. 1 (radula).

[*Non*] *Patelloida profunda*: Turton, 1932, p. 165 (see Tomlin & Stephenson).

I have seen examples from Durban, Morgans Bay, and East London (U.C.T.); and the South African Museum has 3 specimens from Kelso Junction (Natal) collected by Burnup, and named *A. albonotata* by him.

Of the latter, only one has the internal margin marked with rufous spots, though all three have the central area suffused fulvous, as in the specimens of

profunda. Some of these also show indications of spots on the inner margin, and corresponding streaks on the external surface.

Up to 19×14 , alt. 11 mm.; also $19 \times 14 \times 6$ mm.

No circling of gills around the mantle. So far as I am aware the radula of Smith's *albonotata* has not been examined, though possibly Burnup sent the animals of his specimens to Prof. Gwatkin, in whose collection (in Brit. Mus.) there may be a mounted example.

The radula of a Durban specimen is here figured: *c.* 45 rows, no central plate, 2 lateral plates, one behind the other, with retrorse cusps, that of the hinder one bifid, 2 slender curved marginal plates with retrorse spatulate apices.

Hodgkin's figure of the radula of Mauritian examples does not show the apices of the marginal plates as spatulate.

Natal (Krauss); Umkomaas (Natal) (Smith); Kelso Junction (S. Afr. Mus. coll. Burnup); Umhlali (Natal) to East London (Tomlin & Stephenson, Stephenson).

Distribution. Mauritius, Ile Europa, Madagascar.

Remarks. Von Martens gave as a reason for transferring this species to *Acmaea* the smooth spotted ('*glatte farbig gegliederte*') margin. Pilsbry transferred it to *Helcioniscus*, now regarded as a synonym of *Cellana* (in Thiele, 1929, p. 42, the date of the latter should read 1869).

There seems little doubt that *albonotata* should fall into synonymy.

Fam. **Patellidae**

Gen. **PATELLA** Linn.

Stephenson, 1936, p. 74 (habits of S. Afr. species); 1939, pp. 512-528 (distribution of S. Afr. species); Tomlin & Stephenson, 1942, pp. 4-9 (comments and corrections to Turton, 1932, and revised list of S. Afr. species); Stephenson, 1948, pp. 274 sqq. (figs. of radulae); Koch, 1949, pp. 487 sqq., pls. 17-23 and 22 text-figs. (review of S. Afr. species).

Circling of gills not interrupted in front. Radula with central plate, 3 lateral and 3 marginal plates; 1 South African species (*variabilis*) without central plate.

Recent anatomical and biological researches have drastically reduced the number of acceptable species living along the South African coast: Tomlin and Stephenson admitted 12, Koch 11.

Koch's examination of the radulae seems to have placed the taxonomy on a firm basis. I have not had similar opportunities of field collecting, or of examining the radulae of all the species. Those which I have examined confirm Koch's observations, and only one or two points seem to require comment.

The difference between the two types of radulae is more lucidly expressed in the key (p. 512) than in the text (p. 492). The formula for *barbara* and *compressa* includes 4 lateral plates, the outermost pluricuspid [typ. err. pleuri-] lateral is stated to be divided into 'two separate teeth' (*barbara*, p. 493). This

is not borne out by figs. 4 and 8, and conflicts with the family diagnosis. There may be 3 or 4 *cusps* (teeth) on the 3rd lateral plate, but they all arise from an undivided basal plate.

In the European species (e.g. *vulgata*) the innermost (nearest the axis of the radula) is the smallest of the 3 cusps (Fischer-Piette, 1934, p. 280, figs. 1, 2; also Eslick, 1940, p. 52, fig. 3); but in the South African species the outermost cusp is the smallest (Koch's figures and my observations).

The central plate is always much narrower than the 1st lateral plate (contrast Thiele, 1929, fig. 23).

The distribution of the eleven recognized species around the South African coast is shown graphically by Stephenson (1939, fig. 13).

Nardini (1934, pp. 249, 250) records *Patella dunkeri* [= *Helcion d.*], *granularis*, *umbella* [= *miniata*] and *rustica* [= *tabularis*] from Umkomaas, Natal: 'Trovata fossile per la prima volta.' Probably these were merely dead shells from kitchen-middens, not true fossils; there are no Pleistocene deposits at Umkomaas.

For deciding the question whether the South African *Patellas* are endemic, or, in some cases, linked with species from other regions (Stephenson, 1939, pp. 527, 528), it is scarcely necessary to utter the warning that dead shells are useless. Von Martens (1880, p. 299, 300) stated that Prof. Möbius had brought a specimen of *cochlear* from Mauritius, but doubted the provenance of this and earlier records of *granatina*, *oculus*, *miniata*, *compressa*, *spinifera* Lam. [= *plicata* = *barbara*], because these shells so easily get into the hands of collectors. The reverse process has undoubtedly taken place, and collectors are responsible for several Mauritian shells having been recorded as South African!

P. cochlear Born. (see: Stephenson and du Toit, 1937, pls. 21, 23; and Stephenson, 1939, p. 515, text-fig. 8 and pl. 14, fig. 1). The U.C.T. Ecological Survey found this species from Lambert's Bay on the west coast southwards around the coast to Cape Morgan, but not in the Durban area. I have seen a dead shell from Umsikaba River mouth (north of Port St. Johns) (S. Afr. Mus. coll. F. Talbot, 1959).

P. granatina Linn. Tomlin (1926 a, p. 297) considered that *Acmaea apicina* (Gray) was probably Lamarck's *Patella apicina*, which is *granatina*. The most northerly locality on the west coast given by Koch is Port Nolloth; Lüderitzbucht (U.C.T.); Lamy (1931, *Bull. Mus. Paris*, 2nd ser., III, 3, p. 304) records it from Walvis Bay.

P. granularis Linn. Recorded as *natalensis* Krss. from Angola by Nicklès (1950, p. 39, fig. 13); also Franca, 1957 and 1960). Lüderitzbucht (U.C.T.).

P. tabularis Krss. Recorded, as *rustica* Linn., from Maputo-Zitundo and Inhambane by Braga (1952, p. 94, pl. 6, fig. 10). The identification is probably erroneous and may refer to *barbara* Linn., recorded from Natal by Krauss (*obtecta*) and from Delagoa Bay by Macnae and Kalk (1958, pp. 86, 127, fig. 21 f).

P. variabilis Krss. From Bushman's River mouth to Natal (Koch, 1949, p. 510). Inhambane (Braga, 1952, p. 94, pl. 6, fig. 11, as *Helcioniscus v.*).

Lectotype of *P. argenvillei* Krss. in Stuttgart Museum figured (Janus, 1961, p. 3, pl. 2, figs. 1-3).

Gen. HELCION Montfort

Cirlet of gills interrupted in front. Central plate of radula more or less degenerate, 3 lateral plates.

Helcion pectunculus (Gmelin)

Fig. 27 c

Patella pectinata Krauss, 1848, p. 57.

Helcion pectunculus Gmelin, Tomlin, 1923, p. 50; Stephenson, 1948, pp. 279, 282, fig. 10 (radula).

Helcion pectinata Krss., Thiele, 1929, p. 41.

? *Acmaea ordinaria* Turton, 1932, p. 160, pl. 36, no. 1142.

? *Acmaea punicea* Turton, 1932, p. 160, pl. 36, no. 1143.

Shell high, apex vertically over front margin, or nearly so, in adult; with numerous squamose ribs. Up to 31×27 , alt. 14 mm. (highest point behind the apex). High and low forms: $20 \times 17 \times 9$ and $20 \times 17 \times 7$ mm.

Brown or greenish black, sometimes, especially in brown shells with paler radiating streaks.

Radula very long. Central plate very narrow, squeezed between the 1st laterals, 2nd lateral plate a little wider than 1st, each with a strong falcate indurated cusp, 3rd lateral farther back, stouter, with 3 indurated cusps, the inner one falcate, the middle one ovate, the outermost smaller, triangular; 3 marginal plates, the two inner ones with reflexed cutting-edges, the outer one broader.

Lüderitzbucht, Table Bay, False Bay, Still Bay, Mossel Bay, Algoa Bay, Port Alfred, Natal (*auct. et S. Afr. Mus.*). Port Nolloth to East London (U.C.T.).

Remarks. Thiele said the central plate of the radula has a small cutting-edge, but I have not found this in any of my examples.

Helcion pruinus (Krss.)

Patella pruinosa Krauss, 1848, p. 56, pl. 3, figs. 9a, b; Turton, 1932, p. 171, pl. 40, no. 1215.

Patella dunkeri var. *approximata* Turton, 1932, p. 170.

Patella pruinosa Krss., var. *fuscoradiata* Turton, 1932, p. 171, pl. 40, no. 1216.

Helcion pruinus Krss., Tomlin & Stephenson, 1942, p. 8; Stephenson, 1948, pp. 279, 282, fig. 10 (radula).

Shell low, apex well within the margin, sometimes with feeble radiating ribs, but usually quite smooth. Up to 28×21 , alt. 8 mm. (apex usually the highest point).

Grey, brown, olive, horn-coloured, unicolorous or with radiating streaks, often with radiating lines of iridescent blue dots.

Radula as in *pectunculus*.

Lüderitzbucht, Table Bay, False Bay, Hermanus, Still Bay, Mossel Bay, Algoa Bay, Port Alfred (*auct. et S. Afr. Mus.*). Yzerfontein, Table Bay to East

London (U.C.T.). Umsikaba River mouth (north of Port St. Johns) (S. Afr. Mus. coll. Talbot).

Remarks. Juveniles 1.5 mm. long (Still Bay, coll. Muir) have the apex well within the margin.

Helcion dunkeri (Krss.)

Patella dunkeri Krauss, 1848, p. 55, pl. 3, fig. 14; Bartsch, 1915, p. 144; Turton, 1932, p. 170; Nardini, 1934, p. 249, pl. 18 (5), fig. 19.

Patella dunkeri Krss., var. *formosa* Turton, 1932, p. 170, pl. 40, no. 1211.

Patella testudinaria non Linn., Turton, 1932, p. 170.

Helcion dunkeri Krss., Stephenson, 1939, p. 524; Tomlin & Stephenson, 1942, p. 8; Stephenson, 1948, pp. 279, 282, fig. 10 (radula).

Radula as in *pectunculus*.

Cape and Natal (Krauss, *ex coll.* Wahlberg and Dunker). Table Bay (S. Afr. Mus. coll. Lightfoot and K. H. B.). Port Alfred (Bartsch, Turton). Lüderitzbucht, Port Nolloth, Lambert's Bay, Saldanha Bay, Table Bay, Port Elizabeth, East London, Umhlali (Natal) (U.C.T.).

Remarks. Krauss apparently did not himself collect this species. Its occurrence in Natal has not been confirmed. Tomlin & Stephenson have confirmed the identity of specimens collected by Turton at Port Alfred.

There is great difficulty in separating *dunkeri* from *pruinusosus*. Stephenson (1939) remarked that it was suspected to be a form of the latter. *H. dunkeri*, however, has page precedence; and I would reduce *pruinusosus* to a synonym, not even a variety of *dunkeri*.

H. dunkeri is as a rule a little more distinctly ribbed than *pruinusosus*, but some specimens are almost smooth. Shells which are strongly marked with black and white rays may be assigned to *dunkeri*. There are not always 11 black rays; some of them may split into 2-4 narrower rays, with a total of 16-18 black rays; on the other hand there may be only 6-7 rays, or the shell may be black with 2-4 white rays, or completely black. There are also, as Krauss remarked, other colour patterns, and there may be a blue-green sheen on some of the stripes.

The only locality in Table Bay known to the late R. M. Lightfoot and myself where this species (or form) could be found living was the groynes alongside the sewerage outlet on Woodstock beach. Stephenson also found it there.

It is also difficult, as Krauss noted, to separate the shell from juvenile *Patella compressa*. The latter are oval, depressed but not compressed, and up to a length of *c.* 20 mm. lie flat.

Gen. CELLANA H. Adams, 1869

Winckworth, 1928, p. 133.

Tomlin, 1937, p. 176.

Circler of gills interrupted in front. Central plate of radula degenerate, only 2 lateral plates. Shell internally with a satiny, metallic sheen.

Cellana capensis (Gmelin)

Fig. 27 d

Patella capensis Krauss, 1848, p. 53, pl. 3, figs. 13 a-c.*Helcioniscus capensis* Gmelin, Dautzenberg, 1929, p. 551; Braga, 1952, p. 94, pl. 6, fig. 12.*Cellana capensis* Gmelin, Stephenson, 1939, p. 524; 1948, pp. 279, 282, fig. 11 (radula).*Cellana capensis* Gmelin, subsp. *karachiensis* Winckworth, 1930, p. 80.

Radula very long; central plate a narrow strip without indurated cusp, squeezed between the 1st lateral plates, each of which has a strong falcate indurated cusp, 2nd lateral with 2 indurated cusps, the inner one apically bifid, the outer one small, triangular, the composite marginal plate with one reflexed cutting-edge in front and another behind, about in middle of plate.

Yellowish or drab, sometimes with faint darker marks on outer surface, internally with 2, 3 or more dark brown radiating streaks, which are sometimes broken up into spots, central area more or less mottled with orange-brown or dark brown (in juveniles 7-10 mm. long, bright orange).

Living: Port Alfred (S. Afr. Mus. coll. E. K. Jordan 1941); East London (U.C.T.); Umsikaba River mouth (north of Port St. Johns) (S. Afr. Mus. coll. Talbot); Durban (S. Afr. Mus. P.F. coll.); Delagoa Bay (S. Afr. Mus. coll. K. H. B.; also U.W.); Bazarute Island (U.W.); Mozambique Island (S. Afr. Mus. coll. K. H. B.; also U.W.). Recorded by Braga from Inhambane and Mozambique.

Distribution. Madagascar (Dautzenberg); Karachi (Winckworth).

Remarks. Both Krauss (for his fig. 13 b) and Dautzenberg remarked on the similarity of *capensis* with *rota* (Gmelin). The latter stated that *capensis* was larger (!), with the internal central impression white, more or less maculated with brown or orange (*rota*: uniform dark brown).

Karachi specimens were described as differing in having more numerous ribs, alternately larger and smaller, with about 20 (out of 180) stronger ones, and in being more strongly granulate; and also in having 11 brown rays on the inside instead of only 9. All these characters seem to be variable, and of no taxonomic value.

Cellana rota (Gmelin)*Helcioniscus rota* Gmelin, Dautzenberg, 1929, p. 551; Braga, 1952, p. 95.

Radiating ribs numerous and regular, sometimes slightly squamulose at the growth-lines. Up to 25 × 20 mm.

Grey with faint irregular darker marks; interior pale with dark brown spots or more or less zigzag lines, but not radiate, central area mostly white.

Radula as in *capensis*.

Mozambique Island (Braga; also U.W.).

Distribution. Suez, Gulf of Akaba; Lindi (Tanganyika); Madagascar.

TECTIBRANCHIATA

Fam. Actaeonidae

The Angolan species *conicus* Thiele 1925 was placed in *Actaeon* with a query; I consider it more likely to be a *Leucotina* (*Pyramidellidae*).

Actaeon flammeus (Gmelin)

Durban (Sowerby). Off Amatikulu River (Zululand), 13-15 fathoms, 1 dead but fresh (S. Afr. Mus. A6552, P.F. coll.).

Actaeon fortis Thiele

Actaeon fortis Thiele, 1925, p. 259, pl. 42 (30), figs. 10, 11.

A *Pieter Faure* specimen closely resembles Thiele's fig. 11 of a shell from the Zanzibar Channel, except that the punctate-striate sculpture is not so strong on the upper part of the whorl, in this respect being more like *fragilis* Thiele 1925 from Angola; it is also proportionately broader (3 whorls: 4×2.25 mm.).

As Thiele considered the narrower East Indies shells as conspecific with those from East Africa, the Natal shell may also be referred to *fortis*, at least provisionally.

Off Umhloti River (Natal), 40 fathoms, 1 dead (S. Afr. Mus. A9407, P.F. coll.).

Distribution. Zanzibar Channel, 463 metres; also East Indies (Thiele).

Solidula suturalis (A. Adams)

Spire twice (at least) in length of aperture, columella pleat double, sculpture punctate-striate, striae narrower than the lirae.

Port Elizabeth and Natal (Sowerby).

Off Glendower Beacon (Port Alfred), 39 fathoms, 2 dead and worn (identified by Sowerby) (S. Afr. Mus. A5640, P.F. coll.).

Solidula sulcata (Gmelin)

Spire $2\frac{1}{4}$ -2 in aperture; columella pleat double, with an additional costa posterior to it; sculpture punctate-striate, the striae varying in number from 14 or 15 to 36, 25 being about the average, striae (even when numerous) narrower than the lirae. Up to 17×8 mm.

White with grey axial streaks, more or less interrupted at level of top and middle of aperture, thus forming 3 grey zones; in one specimen the streaks are pink, those on the uppermost zone being somewhat undulate or angular.

Fossil: Pleistocene; Durban North Ridge, 60 feet below sea level (Geol.

Survey); Algoa Bay (Johnson, 1904, as *solidula*); Sedgefield near Knysna (A. R. H. Martin); Little Brak River, Mossel Bay (S. Afr. Mus.).

Durban (*sed* ?) (S. Afr. Mus. coll. Ross-Frames).

Off Cape Natal, 54 fathoms, 1 juv.; off Tongaat, 36 fathoms, 1 juv. (S. Afr. Mus. A9422, A9423, P.F. coll.).

Remarks. Corresponds with larger examples in S. Afr. Mus. from New Caledonia.

Solidula niecaensis n.sp.

Spire $1\frac{1}{4}$ in aperture; columella pleat double, with an additional costa posterior to it; sculpture of spiral sulci subequal in width to the lirae, crossed by axial pliculae producing squarish foveolae; 7 sulci on penultimate whorl, 9 on upper part of last whorl, *c.* 15 on base; on back of outer lip the number of lirae and sulci doubled by interpolation. 17×7.75 mm. White, periostracum brown.

Off Nieca River (East London area), 43 fathoms, 1 living (S. Afr. Mus. A6553, P.F. coll.).

Remarks. Although the somewhat foveolate sculpture is similar to that of *albus*, and the specimen was actually identified by Tomlin as *albus*, the shell has a much longer spire relatively to the aperture, and the columella is that of a *Solidula*.

The forepart of the animal had been pulled out, and no radula was obtained.

Pseudactaeon albus (Sow.)

Fig. 28 h

Tornatella albus Sowerby, 1873, p. 720, pl. 59, fig. 6.

Actaeon albus Sow., von Martens, 1903, p. 50; Schwarz, 1910, p. 115.

Pseudactaeon albus Sow., Thiele, 1925, p. 257, pl. 46 (34), figs. 3, 3a, 4 (radula).

Spire 2–2½ in aperture; columella pleat simple. The sculpture is not 'punctate-striate' in the usual sense; the grooves are at least as wide as the lirae, usually a little wider, and are divided by axial pliculae into squarish foveolae; at the base of last whorl the sculpture is sometimes almost cancellate. Up to 15.5×7.5 mm. White, periostracum orange-brown.

Radula large, length 3 mm., width when spread out 4 mm. in shell 15 mm. long; 12 rows, no central plate, 4 widely spaced longitudinal series of small lateral plates, increasing in size outwards, base narrow, with 3–4 cusps, a single large marginal plate consisting of a long curved spine on a short base; when *in situ* the marginals fold inwards over the laterals.

Fossil: Pleistocene, Sedgefield (A. R. H. Martin); Knysna (S. Afr. Mus.); Zwartkops (Schwarz 1910).

Port Elizabeth (Sowerby). $34^{\circ} 54' S.$, $19^{\circ} 37' E.$, 80 metres, 1 living (von Martens). False Bay, 27–28 metres (U.C.T.).

Off Knysna, 30 fathoms, 1 dead; off Cape Recife, 20 fathoms, 1 dead;

34° 5' S., 25° 38' E., 51 fathoms, 1 dead; off Great Fish Point, 40 fathoms, 1 living; off O'Neil Peak (Zululand), 90 fathoms, 1 dead (S. Afr. Mus. P.F. coll.).

Fam. Ringiculidae

Ringicula turtoni Bartsch

Ringicula australis (non Hinds) Sowerby, 1892, p. 25; Smith, 1910, p. 184; Schwarz, 1910, p. 114.

Ringicula turtoni Bartsch, 1915, p. 7, pl. 1, fig. 4; Tomlin, 1931 a, p. 442.

Ringicula africana Bartsch, 1915, p. 7, pl. 33, fig. 4; Tomlin, 1931 a, p. 442.

Ringicula agulhasensis Thiele, 1925, p. 261, pl. 42 (30), fig. 16.

Ringicula scalaris Turton, 1932, p. 5, pl. 1, no. 46.

Ringicula solida Turton, 1932, p. 6, pl. 1, no. 47.

The study of nearly 200 specimens, mostly from the *Pieter Faure* bottom-samples, in various stages of growth and of abrasion, convinces me that only one species occurs in South African waters.

Juveniles are multistriate (*agulhasensis*), adults paucistriate (*turtoni*), though more than 6–7 (*turtoni*, Bartsch's figure; also *scalaris*) may persist on to the last whorl; sometimes only 2 or 3 persist on the lower part of the whorls (just above the suture) which is the part less exposed to wear than the periphery (*africana*).

The shape of the adult is usually rather squat (*turtoni*), especially when the outer lip is well thickened; but high-spined individuals (*africana*, *solida*) occur; *scalaris* of course is an immature example.

R. acutispira Turton is not a *Ringicula*, but probably a worn *Actaeocina*, or perhaps an *Actaeon*.

Up to 5.5 × 3.3 mm. A particularly stalwart high-spined adult measures 6.5 × 3.5 mm. (appropriately it came from off Stalwart Point north of Gr. Fish Point, 53 fathoms).

Fossil: Pleistocene, Sedgefield (A. R. H. Martin); Zwartkops (Schwarz 1910).

Dead, but including fresh and glossy, examples were obtained at numerous localities extending from off O'Neil Peak and Tugela River (Zululand) to Algoa Bay and St. Francis Bay, in depths of 22–90 fathoms. (S. Afr. Mus. A9391–A9402, P.F. coll.).

There are no records from any locality farther west; Dr. Muir did not find it at Still Bay. Recently, however, U.C.T. obtained a dead worn specimen at 34° 17' S., 17° 53' E., 320 metres.

Remarks. Formerly recorded as *australis* Hinds. Thiele (1925, p. 262, pl. 42 (30), fig. 23) recorded the latter species from the Zanzibar Channel and from the East Indies (p. 348); his figure closely resembles an *africana*. Future investigation of the East African area may possibly show that *australis* extends farther south, linking up with Zululand, and that the South African specimens were correctly named *australis*.

R. aethiopica von Martens 1903 (also Thiele 1925) from the East coast of Africa is another form which might be compared when more material is available.

Incidentally *R. congoensis* Thiele (1925, p. 260, pl. 42 (30), fig. 15) looks remarkably like the West African *conformis* Monterosato as figured by Nicklès (1950, p. 135, fig. 277).

Fam. Atyidae

Haminea alfredensis Bartsch

Fig. 28 g

Haminea alfredensis Bartsch, 1915, p. 6, pl. 1, fig. 5.



FIG. 28. a, *Retusa natalensis* n. sp., with apical view; b, *Volvula mutabilis* n. sp., with apex of juv. 2.75 mm., and immature shell 3 mm.; c, *Actaeocina natalensis* n. sp.; d, *Actaeocina* species A; e, *Actaeocina* species B. Radula plates of: f, *Haminea gracilis* Sow.; g, *H. alfredensis* Bartsch; h, *Pseudactaeon albus* (Sow.), with portion of radula showing lateral plates in situ (semidiagrammatic); i, *Cylichna tubulosa* Gould.

This may have to become a synonym of *natalensis* (Krss.). Turton seemed to think that the pear-shaped *alfredensis* graded into the oval *natalensis*. The pear shape is more noticeable in the larger shells; juveniles 3.5–4 mm. long are oval.

But neither in these juveniles nor in any specimen I have seen does the posterior margin of the outer lip extend so prominently beyond the apex as in Krauss's figure. I have seen no Natal specimens.

The largest specimen measures 19 × 13 mm., and came from Little Brak River estuary, near Mossel Bay.

Stomach plates semicircular, with transverse pleats (cf. Thiele, 1929, fig. 486, *natalensis*, after Bergh).

Radula with *c.* 25 rows, central plate notched on front margin, sharp median cusp flanked by a rounded lobe bearing when unworn a small cusp, 23–26 hamate lateral plates, decreasing in size outwards, 1st lateral not dentate.

False Bay, Still Bay, Mossel Bay, Plettenberg Bay, Port Alfred (S. Afr. Mus.).

Specimens with egg-ribbons have been found in the estuary of the Silvermine River (Fish Hoek, False Bay) in March.

Haminea gracilis Sow.

Fig. 28 *f*

Haminea gracilis Sowerby, 1897, p. 20, pl. 6, fig. 16; von Martens, 1903, p. 50.

More cylindrical than *alfredensis-natalensis*, nearly parallel-sided, with extremely fine spiral striae, some of the growth-lines stronger than others, subpliculose. 11×6.5 mm. Pale straw- or amber-coloured.

Radula with *c.* 30 rows, central plate feebly indented on front margin, sharp median cusp flanked by a rounded lobe carrying when unworn a small cusp, 12–15 similar, simple (non-serrate), curved lateral plates.

Durban (Sowerby). $34^{\circ} 21' S.$, $20^{\circ} 22' E.$, 117 metres, 1 living (von Martens). Karridene (south of Durban) (S. Afr. Mus.). St. Lucia Bay, 1 living (U.C.T.).

Remarks. The *Valdivia* shell had the greatest width nearer the middle than in Sowerby's figure, and von Martens was unable to find any spiral striation.

Fam. **Aceridae**

Acera soluta Gmelin

This Indian Ocean species was recorded by Smith (1903, p. 357) from Durban. I have received living specimens from Port Elizabeth and Knysna.

Fossil: Pleistocene, Port Elizabeth. 'From the immense numbers of the *Akeræ* found in it, I have termed it the *Akera-stratum*' (Stow, 1871, p. 517).

Fam. **Retusidae**

Retusa truncatula (Brug.)

Retusa truncatula Smith, 1904, p. 38; Bartsch, 1915, p. 4; Turton, 1932, p. 3, pl. 1, no. 27.
Retusa atlantica Thiele, 1925, p. 269, pl. 43 (31), fig. xi (? fig. 12).

Thiele's fig. 11 of a South African shell seems to portray the same species as that previously identified by Smith and Bartsch as the European *truncatula*. It came probably from Simon's Bay where the *Gauss* obtained other shells described by Thiele (1912). The specimen fig. 12 from Great Fish Bay, Angola, however, seems somewhat different; but if the South African shells are really the European species, the locality links South Africa with West Africa.

I can find no differences between South African and British shells. The apical cavity is wide, and the axial riblets show on the sunken penultimate whorl.

Fossil: Pleistocene, raised beach Knysna (S. Afr. Mus.).

Port Alfred (Smith, Bartsch, Turton). Still Bay, 0.6 up to 2 mm. (S. Afr. Mus. Muir coll.).

Retusa agulhasensis Thiele

Retusa agulhasensis Thiele, 1925, p. 270, pl. 43 (31), figs. 10, 10a.

Slightly barrel-shaped, apical cavity narrow, columella with pleat, no axial sculpture, 4 spiral striae on base. 4.5 × 2.3 mm.

35° 16' S., 22° 26' E., 155 metres, 2 (Thiele).

No examples of this species were found in the *Pieter Faure* bottom-samples.

Retusa natalensis n.sp.

Fig. 28 a

Parallel-sided, slightly narrower anteriorly, apical cavity narrow, columella pleat weak, outer lip carinate on top, not expanded anteriorly, aperture posteriorly rectangular, no sculpture, fine growth-lines which are best seen on the shoulder. 4 × 1.5 mm.

Off Umkomaas River (Natal), 40 fathoms, 2 (S. Afr. Mus. A9409, P.F. coll.).

Retusa cf. *nicobarica* Thiele

Retusa nicobarica Thiele, 1925, p. 270, pl. 43 (31), fig. 13.

Egg-shaped, columella with blunt projection. The present specimens agree with Thiele's description and figure, and are of the same size: 3.3 × 2 mm.

If Thiele had recorded specimens also from the Zanzibar Channel, I would have had no hesitation in identifying the Natal-Zululand shells with his species; but it is better to record them as only comparable with *nicobarica*.

Off Cape Natal, 85 fathoms, 9 dead; off Cape Vidal (Zululand), 85-100 fathoms, 4 dead (S. Afr. Mus. A9420, A9421, P.F. coll.).

Distribution. Nicobars (7° 48' N., 93° 7' E.), 804 metres (Thiele).

Retusa (*Pyrunculus*) cf. *semen* Thiele

Retusa semen Thiele, 1925, p. 271, pl. 43 (31), fig. 17.

Two dead but fresh specimens agreeing with Thiele's species.

Off Hood Point (East London area), 49 fathoms, 2 (S. Afr. Mus. A9408, P.F. coll.).

Distribution. Zanzibar Channel, 463 metres; East Indies, 470 metres (Thiele).

Volvula pia Thiele

Volvula pia Thiele, 1925, p. 272, pl. 43 (31), fig. 21.

Apex rounded, with very small apical pit, no sculpture. 2.6×1.1 mm.
 $34^{\circ} 51' S.$, $19^{\circ} 37' E.$, 80 metres, 1 (Thiele).
 Not taken by the *Pieter Faure*.

Volvula mutabilis n.sp.

Fig. 28 b

Nearly symmetrically oval, apex in immature sharply, in adult bluntly pointed, 5-6 distinct though fine spiral striae at apex and base, middle of whorl with extremely fine spiral striae, growth-lines fine, columella with pleat, aperture not expanded anteriorly. Up to 4×1.75 mm.

Off Umhloti River (Natal), 40 fathoms, 3 adult, 1 immature (Types); off Cape Natal (Durban), 54 fathoms, 1 adult, 1 immature; off Tongaat River, 36 fathoms, 1 immature (S. Afr. Mus. A9410 (Types), A9411, A9412, P.F. coll.).

Remarks. Although an acute, thorn-like apex is usually regarded as a specific character, I think the present series, small as it is, shows that the pointed apex of the juvenile gradually becomes blunter in the adult.

The smallest (2.75 mm. long) of the present immature shells closely resembles *fortis* Thiele 1925 from the East Indies, but the latter is larger and is smooth in the middle between the spiral striae at each end. But the adult is nearer in shape to *suavis* Thiele 1925 from Angola.

Fam. **Scaphandridae***Scaphander punctato-striatus* (Mighels)

Scaphander punctato-striatus Sars, 1878, p. 292, pl. 18, fig. 6 (shell), pl. xi, fig. 14 (radula); Watson, 1886, p. 642; Sowerby, 1903, p. 232.

Sowerby saw only 2 specimens; and returned the one from 166 fathoms. This was a dead specimen, but still retains most of the periostracum. A similar specimen was obtained in 180 fathoms; 1 living specimen was obtained in 190 fathoms, and 2 in 755 fathoms.

Additional localities: Cape Point N. $50^{\circ} E.$ 18 miles, 180 fathoms, 1 dead but fresh; off Table Bay, 190 fathoms, 1 living; Cape Point NE. $\times E.$ $\frac{1}{4} E.$ 38 miles, 755 fathoms, 2 living; Cape Point NE. $\times E.$ $\frac{1}{4} E.$ 40 miles, 800-900 fathoms, 3 dead; Cape Point N. $58^{\circ} E.$ 49 miles, 900+ fathoms, 1 dead; Cape Point NE. $\times E.$ $\frac{1}{4} E.$ 46 miles, 900+ fathoms, 5 dead; Cape Point N. $77^{\circ} E.$, 660 fathoms, 2 dead; Cape Point NE. $\frac{3}{4} E.$ 40 miles, 720-800 fathoms, 2 dead; Cape Point N. $70^{\circ} E.$ 40 miles, 800 fathoms, 3 dead (S. Afr. Mus. P.F. coll.).

One living juvenile, 9 mm. long, was recently (1959) obtained by Mr.

Talbot: $33^{\circ} 45\frac{1}{2}'$ S., $16^{\circ} 23\frac{1}{2}'$ E., 1,480 fathoms. It has the characteristic sculpture, but the apex is visible, not covered by the advancing outer lip. Radula as in *Scaphander*.

Distribution. North Atlantic, West Indies, Mediterranean, Azores.

Scaphander sp.

Four specimens, the largest 7×4 mm., are left undetermined pending further and better material. Surface with impressed spiral striae which are minutely punctate.

Off Cape Natal (Durban), 85 fathoms, 1 broken; off Cape Vidal (Zululand), 80–100 fathoms, 2 dead; off O'Neil Peak (Zululand), 90 fathoms, one dead (S. Afr. Mus. A9403–5, P.F. coll.).

Bullaria ampulla (Linn.)

Bullaria ampulla Linn., Turton, 1932, p. 5, pl. 1, no. 39 (juv. 1.8 mm. long).

Fossil: Pleistocene, Little Brak River (Smith in Rogers, 1906b); Sedgfield (A. R. H. Martin); Knysna raised beach (S. Afr. Mus.); Port Elizabeth (Johnson, 1904, Schwarz, 1910).

Fresh specimens, including juveniles 7 mm. long, are washed up on the beach at Still Bay (Dr. Muir); but S. Afr. Mus. has no records from farther west.

Gen. ACTAEOCINA Gray (syn. *Tornatina* A. Adams)

Only a dozen specimens were obtained from the *Pieter Faure* bottom-samples; none of them is with certainty referable to *nitens* (Thiele) 1925 or *agulhasensis* (Thiele) 1925. Thiele's *nitens* from $35^{\circ} 19'$ S., $20^{\circ} 12'$ E., 126 metres, is not unlike the Natal *meridionalis* (Smith) 1902; *agulhasensis* from $35^{\circ} 16'$ S., $22^{\circ} 26'$ E., 155 metres, appears to have the columella pleat nearer the base, and an oblique suture.

Provisional synopsis

Protoconch projecting prominently			
Sides parallel; suture horizontal	..	..	.. <i>smithi</i>
Slightly ovate; suture oblique	..	..	.. <i>natalensis</i>
Protoconch sunken, hemispherical			
Columella pleat at lower one-third			
Suture horizontal	..	..	.. <i>meridionalis nitens</i>
Columella pleat at lower one-quarter			
Protoconch moderate			
Suture oblique	..	..	.. <i>agulhasensis</i>
Suture horizontal	..	..	.. species A
Protoconch large (0.25 mm. diam.)	..	..	.. species B

Actaeocina smithi Bartsch

Tornatina voluta (non Q. & G.) Sowerby, 1892, p. 52.

Actaeocina smithi Bartsch, 1915, p. 4, pl. 1, fig. 9; Turton, 1932, p. 3.

See synopsis. Extremely fine spiral striae at base. Up to 5.5×2.5 mm.

Port Elizabeth (Sowerby); Port Alfred (Bartsch); East London (S. Afr. Mus. coll. R. M. Lightfoot); off Cove Rock (East London), 22 fathoms; and Algoa Bay, 33 fathoms (S. Afr. Mus. P.F. coll.).

Actaeocina natalensis n.sp.

Fig. 28 c

Protoconch prominently projecting, shape of shell slightly ovate, suture oblique. 5×2 mm.

Off Illovo River (Natal), 27–30 fathoms, 2 dead (S. Afr. Mus. A9388, P.F. coll.).

Actaeocina sp. A

Fig. 28 d

Agrees with *agulhasensis* in having the columella pleat low down, but has suture horizontal, i.e. the top of the outer lip is near the top of preceding whorl. 3.5×1.5 mm.

Off Illovo River (Natal), 27–30 fathoms, 1 dead (S. Afr. Mus. A9389, P.F. coll.).

Actaeocina sp. B

Fig. 28 e

Protoconch conspicuously large, diam. 0.25 mm., sunken, hemispherical, shape of shell slightly ovate, suture horizontal, columella pleat low down. 2.5×1.25 mm.

$34^{\circ} 27' S.$, $25^{\circ} 42' E.$, 256 fathoms, 2 dead; $33^{\circ} 3' S.$, $27^{\circ} 57' E.$, 32 fathoms, 1 dead (S. Afr. Mus. A9390 and A9406, P.F. coll.).

Cylichna tubulosa Gould

Fig. 28 i

Cylichna tubulosa Gould, 1859, p. 40; Bartsch, 1915, p. 5, pl. 3, fig. 5.

Cylichna cylindracea (non Pennant) Sowerby, 1892, p. 52.

Cylichna affinis Thiele, 1925, p. 275, pl. 44 (32), fig. 4.

Cylichna algoensis Thiele, 1925, p. 275, pl. 44 (32), fig. 5.

Shell cylindrical, aperture not expanded anteriorly. Very fine wavy orange-brown spiral lines across whole whorl from apex to base, or reduced to 5–6 at top of whorl; usually a narrow orange-brown band outside the columella. Growth-lines fine, some of them a little stronger, but scarcely pliculose. Up to 12 mm. (Turton); 9.3×3.3 mm. (S. Afr. Mus.).

Radula with 20 rows, central plate with finely ctenate cutting-edge,

lateral plate large, uncinata, ctenate on inner margin, 2 simple hamate marginal plates.

Simon's Bay (False Bay) (Gould, Bartsch); Port Elizabeth (Sowerby); Port Alfred (Bartsch, Turton). St. Francis Bay and Algoa Bay (Thiele).

False Bay, 14 fathoms, 1 living, 1 dead; 34° 5' S., 25° 55' E., 67 fathoms, 3 dead; off Keiskamma Point, 33 fathoms, 2 dead; off Cove Rock (East London), 22 fathoms, 3 dead; off Cape Natal (Durban), 47 fathoms, 4 dead; off Umhloti River, 40 fathoms, 3 dead (S. Afr. Mus. A6551, A9416-8, A5583, A9419, P.F. coll.).

Plettenberg Bay, 26-53 fathoms; and 36° 26' S., 21° 11' E., 100 fathoms (U.C.T.).

Distribution. Great Fish Bay, Angola (Thiele).

Remarks. One of the Cape Natal shells is large (9.3 mm.); all the others are juvenile (2.5-5 mm.).

C. bistrata Tomlin 1920, with 2 spiral striae at top of whorl, seems distinct in having the top of the outer lip projecting above the apex.

Cylichna dulcis Thiele

Cylichna dulcis Thiele, 1925, p. 275, pl. 44 (32), fig. 6.

Shell narrowing at base, less conspicuously tubular than *tubulosa*, outer lip anteriorly more strongly curved than the bluntly rounded margin of *tubulosa*; columella larger, and less oblique to the axis. Surface very finely spirally striate (Thiele); surface worn in present specimen. 4 × 1.75 mm. (S. Afr. Mus.); 3.6 × 1.4 mm. (Thiele).

35° 26' S., 20° 56' E., 1 (Thiele).

Off Illovo River (Natal), 27-30 fathoms, 1 dead (S. Afr. Mus. A9414, P.F. coll.).

Roxania utriculus (Brocchi)

Atys utriculus Brocchi, Sars, 1878, pl. xi, figs. 2a, b (radula).

Roxania simillima Thiele, 1925, p. 277, pl. 44 (32), fig. 17, and pl. 46 (34), fig. xi (radula).

Whole whorl closely covered with spiral series of punctae, but with impressed punctate striae only at top and base. Up to 12 × 8 mm.

St. Francis Bay, 80 metres; Algoa Bay; 35° 29' S., 21° 3' E., 102 metres; 35° 21' S., 20° 22' E., 117 metres (Thiele).

Off Kowie (Port Alfred), 40 fathoms, 1 dead; Algoa Bay, 52 fathoms, 1 dead; False Bay, 24 fathoms, 1 living (S. Afr. Mus. A5646-8, P.F. coll.).

Distribution. Great Fish Bay, Angola (Thiele). Europe.

Remarks. The three *Pieter Faure* specimens were identified by Sowerby as *Atys (Roxania) utriculus* Brocchi. The *Valdivia* shells are doubtless conspecific; and as Thiele recorded the species also from Angola it will probably be found at other localities on the west coast of Africa linking up with Europe.

Thiele (1925, p. 265) accepted *Roxania* with subgen. *Sabatia* in the

Scaphandridae. In 1929 (p. 391), however, he regarded *Roxania* Gray 1847 as preoccupied by *Roxana* Stephens 1834, and adopted *Sabatia* Bellardi as the generic name.

Fam. **Philinidae**

Gen. PHILINE Ascanius

The species of this genus cannot be diagnosed from the shell alone; giving names to isolated shells is useless. At present there is only one *fully diagnosed* species in South African waters: *aperta*. *P. berghi* is known only from a single specimen, the shell of which was not specifically described (Bergh: '... of usual form').

It was pure assumption on the part of Bartsch (1915) and Turton (1932) to identify Port Alfred shells as *berghi*. Turton's figure (1932, pl. 1, no. 66) shows a prominent, almost scabrous, liration on the shell.

P. minuta Thiele 1925 has a finely striate shell, but is only 2 mm. long, and is surely a juvenile.

Philine aperta (Linn.)

Philine aperta Bergh, 1907, p. 24, pl. 5, figs. 5-10; O'Donoghue, 1929, p. 7, pl. 1, figs. 1-7.

As defined by Bergh this species has stomach plates, radula without marginal plates (formula 1.0.1), and a smooth non-striated shell showing growth-lines only. Shell: up to 40×31 mm.

False Bay, 10-18 fathoms; off Cape Natal and Umvoti River (Bergh).

False Bay (S. Afr. Mus.; also U.C.T.). Port Elizabeth (P.E. Museum).

Remarks. Presumably Bergh tested the anatomical features of the Natal examples, and found them corresponding with the Cape examples.

Fossil examples, attributed to *aperta*, have been recorded from: Pleistocene, Bogenfels (Haughton, 1932); Sedgfield (A. R. H. Martin); Port Elizabeth (Johnson, 1904; Schwarz, 1910).

Philine berghi Smith

Philine capensis (non Pfr.) Bergh, 1907, p. 27, pl. 5, figs. 11-15.

Philine berghi Smith, 1910, p. 184.

Philine berghii Smith, O'Donoghue, 1929, p. 10.

With stomach plates, radula with 2 marginal plates (formula 2.1.0.1.2). Shell presumably smooth; if it had been striated Bergh would surely have mentioned the fact; he figured only an apical view.

The locality as quoted by Bergh is misleading: the correct locality is Cape Point bearing SW. \times W., i.e. *within* False Bay ($4\frac{1}{2}$ miles 'off Cape Point' in a direction SW. \times W. would be outside False Bay).

Philine sp.

For purposes of record a single shell from off O'Neil Peak (Zululand), 90 fathoms (S. Afr. Mus. A9385, P.F. coll.), may be mentioned. Spirally striate, but finer than in Turton's figure, pl. 1, no. 66. 10×7 mm.

Philine sp.

Philine berghi (non Smith) Turton, 1932, p. 8, pl. 1, no. 66.

Dr. Muir obtained at Still Bay 4 very juvenile shells, 0.8–1 mm. long, which correspond with Turton's figure. The dark band covers 7–8 spiral lirae which are catenulate (see Turton's figure and compare Sars, 1878, pls. 18 and 26). In Turton's figure of a 5 mm. shell the band covers about 14 lirae.

Fam. **Gastropteridae***Gastropteron* sp.

Two specimens of a species of this genus were taken by Dr. F. H. Talbot (Marine Biologist, South African Museum) at the following localities: 33° 52' S., 16° 51' E., 1,380–1,520 fathoms; 34° 05' S., 16° 58' E., 1,470–1,490 fathoms (S. Afr. Mus. A9833, A9847).

Without material for comparison, I attach no specific name to these specimens. Eyes absent. Radula with 15 rows, inner plates not serrulate.

POLYPLACOPHORA

Krauss, 1848, pp. 36–43; Thiele, 1906 *b*, pp. 328–330 and 335, 336; Nierstrasz, 1906, pp. 487–520, pl. 26, figs. 1–29, pl. 27, figs. 30–53 (explanation of figures on pp. 518–520 incorrect); Ashby, 1928, pp. 76–93, pls. 6–8; Thiele, 1929, pp. 1–22; Ashby, 1931, pp. 1–59, pls. 1–7 and 2 text-figs.

The more important papers dealing with South African Chitons are listed above. Ashby made no mention of Nierstrasz's work (except one bibliographic reference to one species); references are therefore given here to all the species recorded by Nierstrasz.

For convenience the arrangement of the families and genera here follows Ashby (1931), which differs slightly from that of Thiele (1929).

Ashby's 1928 and 1931 photographic illustrations are of unequal quality, some are good, others quite useless for showing details.

The radula throughout the group consists of 17 plates in each row, with only minor modifications in some of the plates.

A study of the aesthetes and eyes on the valves of South African Chitons has not yet been undertaken.

The breeding habits of South African Chitons also await investigation. One species, *C. nigrovirescens*, is known to shelter its young under the mantle (perinotum). Plate (1899, p. 100, and 1901, p. 477) recorded two similar cases: *I. imitator* from South America and *C. polii* from the Mediterranean. He also recorded (*SB. Ak. Wiss. Berlin*, 1898, p. 217, and 1899, pp. 159–161, figs. 278, 279) a case of viviparity: *Callistochiton viviparus* Plate. Recently *Ischnochiton hewitti* has been observed to shelter its young.

Fam. **Cryptoplacidae**

Thiele, 1929, p. 12.

Ashby, 1931, pp. 7, 54 (*Acanthochitonidae*).

Ashby (1926, p. 10) argued that because neither *Cryptoconchus* Burrows 1815, Guilding 1829, nor *Cryptoplax* Blainv. 1818 were recognized as 'typical' genera, whereas *Acanthochiton* Grey 1821 (emend. Hermannsen 1846) *Acanthochites* Leach, Risso 1826 was so recognized, the family name must be derived (International Rules) from that of the 'type' genus. Straightforward priority, untrammelled with questions of phylogeny or specialization (on which opinions may differ from time to time) seems preferable.

Iredale (1914, pp. 128, 129) suggested *Cryptoconchidae*, *Cryptoconchus* Burrows 1815 being the earliest name, if its use by Burrows were recognized.

Acanthochiton garnoti (Blainv.)

Acanthochites garnoti Blainv., Nierstrasz, 1906, p. 498, pl. 26, figs. 25-29, pl. 27, fig. 30.

Acanthochiton garnoti Blainv., Ashby, 1931, p. 7, pl. 1, figs. 1-4.

Acanthochiton turtoni Ashby, 1931, p. 8, pl. 1, fig. 5, pl. 2, figs. 6-8.

Acanthochiton turtoni var. *tenuigranosus* Ashby, 1931, p. 10, pl. 2, fig. 13 (useless!).

Valves much subject to corrosion. Low-arched (*garnoti*) and subcarinate (*turtoni*) examples can be found in the same locality.

Sculpture on unworn valves: dorsal area finely longitudinally liriate, pleural-lateral area with close-set flattened circular or oval pustules.

The two slits on the tail valve are widely separated. Ashby said the tail valves of *garnoti* and *turtoni* differed in shape; but his figures (pl. 1, fig 4, and pl. 2, fig. 8, respectively) are taken from different viewpoints, and that of *turtoni* has been printed inverted.

Up to 43 mm. (Nierstrasz). Usually brown or greenish-brown, with dark median stripe flanked by 2 anteriorly diverging white or pale stripes; girdle dull greenish, with bundles of pale green bristles.

One Cape Peninsula specimen (U.C.T.) has the girdle white with orange-chestnut bristles, and the small spicules, especially at head and tail ends, black.

A 10-mm. specimen from Algoa Bay (U.C.T.) has the valves deep orange, the girdle lemon-yellow, the bristles pinkish with white tips.

Radula with *c.* 60 rows, the major (or hooked) lateral plate tricuspid.

Saldanha Bay, Table Bay, and False Bay to Port St. Johns (*auct.*, S. Afr. Mus., and U.C.T.).

Remarks. Von Martens (1880, p. 300) recorded *garnoti* from Mauritius, and suggested that the South African *fascicularis* (Linn.) might be the same species. The latter is recorded from Mauretania and Senegal (Leloup, 1937 *b*).

Acanthochiton variegatus Nierstrasz

Acanthochiton variegatus Nierstrasz, 1906, p. 500, pl. 27, figs. 31-37.

Illovo or Isipingo (Natal) (Nierstrasz). One specimen 6 × 2.5 mm. Sculpture as in *garnoti*. According to the description and fig. 33, the tail valve has 2 slits which are relatively close together, and thus seem to offer a differential character separating the species from *garnoti*. This may, however, be a juvenile character. As in *garnoti* there are 18 bundles of bristles.

In spite of Nierstrasz's express statement that the tail valve had only 2 slits and was therefore an *Acanthochiton* s. str., Ashby made this species a synonym of *Notoplax productus*.

Notoplax productus (Pilsbry)

Notoplax productus Pilsbry, Ashby, 1931, p. 10, pl. 1, figs. 9-12 (part only of synonymy).

Tail valve with 4 slits (Ashby), but 6 seems more usual.

As preserved up to 50-55 mm. (U.C.T.). Valves dull pinkish-orange, or pink and white, or the middle valves orange; girdle rose mottled with white, or bright orange, or crimson; underside of girdle pinkish or greyish (U.C.T.).

Jeffreys Bay (Ashby); False Bay, Danger Point, and Algoa Bay (U.C.T.).

Remarks. The convexity of the tail valve and the plane of the insertion plate may perhaps change with age. In a young specimen with width of tegmentum (sculptured part) of median valve 4 mm. the tail valve is slightly convex, the insertion plate is in a plane at 45° with it, and is fully visible in dorsal view. In specimens with valve width 6, 7 and 8 mm. (and larger ones) the insertion plate is nearly or quite vertical and scarcely visible in dorsal view. The convexity of the tail valve becomes more conspicuous in larger specimens. But many more very juvenile specimens must be examined before a change in the plane of the insertion plate can be regarded as normal.

Another feature which might be determined on living material is whether the width of the girdle relatively to the visible, sculptured width of the median valve increases with age.

Craspedochiton (*Thaumastochiton*) *isipingoensis* (Sykes)

Fig. 29 a, b

Onithochiton ? *isipingoensis* Sykes, 1901, p. 259, fig. (median and tail valves inverted).

Thaumastochiton isipingoensis Sykes, Thiele, 1909b, p. 116.

Craspedochiton (*Thaumastochiton*) *isipingoensis* Sykes, Iredale, 1914, p. 124; Tomlin, 1926, p. 297.

Notoplax productus Pilsbry part, Ashby, 1931, p. 10.

Notoplax umgaziana Koch, 1951, p. 211, pls. 23-25.

A specimen, identified by Tomlin, from off Umkomaas, Natal, 40 fathoms (S. Afr. Mus. A5339, P.F. coll.), has been partly damaged. The girdle shows 4 obscure pits in front of the head valve, and others along the sides. The sculpture consists of close-set flattened pustulate tubercles, increasing in size outwards; on head valve 5 larger tubercles around the front margin. Dorsal area of median valves with 2 ribs forming a V, enclosing a few pustules which form transverse connecting bars.

Head valve with 5 slits (but damaged), middle valves with one slit, tail valve with 6 slits and some irregular crenulations, the insertion plate descending vertically, in fact sloping slightly forwards (fig. 29b).

As preserved approximately 18 mm. long.

Isipingo (Natal) (Sykes); Umgazana (south of Port St. Johns (Koch). 30° 47' S., 30° 27' E. (off Port Shepstone, Natal), 36 metres (U.C.T.).

Remarks. Ashby includes Sykes's species in the synonymy of *Notoplax productus*. The similarity in the dorsal sculpture certainly supports this view, and I am strongly inclined to agree with Ashby. The greater convexity of the tail valve in *isipingoensis*, becoming conical and upturned in the *umgaziana* form, is scarcely an impressive difference.

Iredale did not mention *N. productus*, but after examining Sykes's Type in the British Museum agreed with Thiele that the South African species was closely related to the Mauritian *möbiusi* Thiele 1909 (see Thiele, 1929, figs. 6, 7).

Although considerably larger: 48×35 mm., *Notoplax umgaziana* Koch seems to be synonymous. In dorsal view Koch's and Sykes's figures of the tail valve are much alike, the insertion plate invisible. Sykes said the tail valve

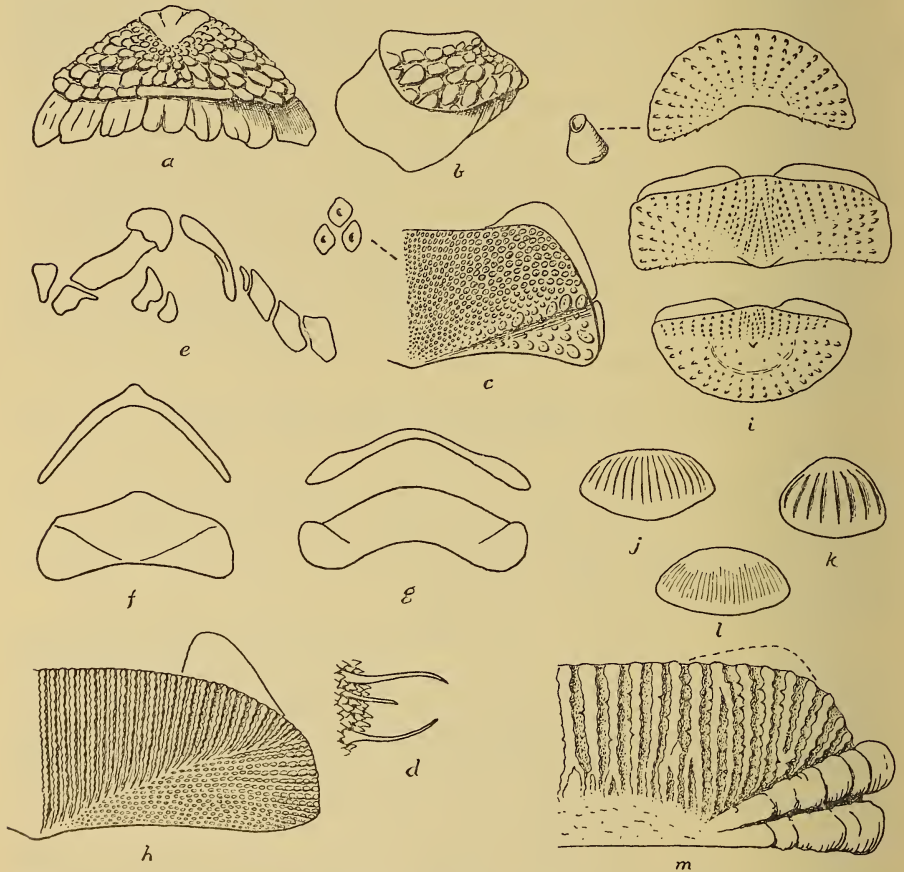


FIG. 29. a, b, *Thaumastochiton isipingoensis* (Sykes), posterior and lateral views of tail valve; c, d, e, *Plaxiphora parva* Nierstrasz, right half of middle valve, portion of girdle, and radula plates; f, g, *Dinoplax gigas* (Gmelin), dorsal view, with section, of middle valve of high and low shells, angle of divergence 85° and 135° respectively; h, *Lepidopleurus chariessa* n. sp., right half of middle valve; i, *Chaetopleura pomarium* n. sp., head, middle, and tail valves; j, k, l, girdle scales of *Ischnochiton textilis* (Gray), *I. hewitti* Ashby, and *I. oniscus* (Krss.) respectively; m, *Chiton ashbyi* n. sp., right half of middle valve (sutural lamina abraded).

was 'obtusely beaked behind'; Koch said 'markedly turned up' and showed it thus in pl. 24, fig. 3 and pl. 25, fig. 6 *b*. The original mucro seems to get pushed up by later growth. There were no specimens in the Transvaal Museum in 1959; and Mr. Koch informed me that his mollusc collection was in storage and not available for re-examination.

Recently (1963), however, I have seen a specimen from The Haven (between East London and Port St. Johns) collected by U.C.T., which is obviously *umgaziana*. The girdle has a ridge as in Koch's figure (pl. 23); this is not distinctive, it occurs in *productus* and in *möbiusi*. The width of the girdle almost equals the visible width (sculptured) of median valve. The over-all length (slightly curved) is 50 mm. (perhaps 55 mm. when alive), width 42 mm.; length of shell 40 mm., width of median valve (sculptured part) 15 mm. The tail valve has the mucro upturned, and the insertion plate with 5 or 6 irregular slits is not visible in dorsal view.

I feel sure that *umgaziana* is only the adult of *isipingoensis*, and the latter is very likely a synonym of *möbiusi*. What is the difference between *möbiusi* and *productus*?

I have also seen a specimen 40 × 27 mm. (girdle slightly shrunken) from Xora (Elliotdale Division) (between The Haven and Umgazana) (C. Walker, 1961). The tail valve is obtusely beaked behind, but not upturned. Also one 40 mm. in length (inc. girdle) with upturned tail valve, from Kei River mouth (D. H. Kennelly).

Cryptoplax sykesi Thiele

Cryptoplax cf. *striatus* Lam., Sykes, 1900, p. 164, figs. 2-5.

Cryptoplax sykesi Thiele, 1909*b*, p. 53, pl. 6, figs. 83-86; Ashby, 1931, p. 12, text-fig. 2 *a-d* (copy of Sykes's figs. 2-5).

Umkomaas (Natal) (Sykes).

Remarks. Sykes (1907, p. 33) compared specimens from Zanzibar with the Australian *striatus* Lam.

Fam. **Lepidopleuridae**

Thiele, 1929, p. 6.

Lepidopleurus sykesi (Sow.)

Chiton (*Hanleya*) *sykesi* Sowerby, 1903, p. 225, pl. 5, fig. 13.

Lepidopleurus sykesi Sow., Thiele, 1906*b*, p. 328, pl. 29, figs. 6-8; Ashby, 1931, p. 15, pl. 2, figs. 16-19.

Some examples are more strongly ridged than described by Thiele or Ashby, having an angle of divergence of 80°. Middle valve up to width 8.5, length 4.5 mm.

Off Cape Point, 210 and 166 fathoms (Sowerby; P.F. coll.).

Off Cape Point, west coast of Cape Peninsula, and Table Bay, 125-230 fathoms, living (Ashby, S. Afr. Mus. P.F. coll.).

Type in the South African Museum (A5342).

33° 41' S., 18° 03' E., 178 metres; 34° 33' S., 18° 21' E., 318 metres; 34° 20' S., 18° 36' E., 70 metres (Thiele).

31° 50' S., 16° 50' E., 330 metres (U.C.T.).

Remarks. At a station NW. of Table Bay, 190 fathoms, the *Pieter Faure* obtained about 65 living examples.

Lepidopleurus chariessa n.sp.

Fig. 29 *h*

Head valve with *c.* 60 fine radiating moniliform pliculae (or lines of granules). Middle valves ridged, dorsal-pleural area with *c.* 50 fine moniliform pliculae, lateral area not raised (or only very slightly), distinguishable only from the dorsal-pleural area by the alteration in direction of the pliculae, and even this is not very clear at the margin, with close-set round granules in quincunx, becoming more or less radial near margin; growth-lines only near margin, and feeble. Tail valve with umbo slightly in front of centre, area in front with *c.* 45 fine longitudinal moniliform pliculae, area behind umbo with *c.* 60 radiating moniliform pliculae.

No insertion plates. Girdle with fine spicules (but not in good condition).

Animal mostly decomposed; enough flesh remained to hold the valves together, but no radula was obtained.

Width of median valve 5, length 2.3 mm. Angle of divergence *c.* 105°.

Off Cape St. Blaize, 125 fathoms, 2 living (S. Afr. Mus. A9338, P.F. coll.).

Remarks. Not so strongly ridged as *sykesi*; sculpture, though fine and delicate, not so fine as in *sykesi*, the latter having for example on head valve *c.* 80 rows of granules; moreover the sculpture is definitely more radial and longitudinal than quincuncial.

The feminine form for the specific name is used because more euphonious than the neuter 'charien'.

Fam. **Lepidochitonidae**

Thiele, 1929, p. 7 (Lepidochitonidae); Ashby, 1931, p. 16 (*Callochitonidae*).

Callochiton castaneus (Wood)

Callochiton castaneus (Wood) Nierstrasz, 1906, p. 496, pl. 26, figs. 22-24; Ashby, 1931, p. 18, pl. 2, fig. 24, pl. 3, figs. 25-27.

Table Bay, Still Bay, Port Alfred. Port Nolloth to Oudekraal (west coast of Cape Peninsula); False Bay to East London and Qolora (U.C.T.).

Up to median valve width 30, shell length *c.* 55 mm.

Fam. **Mopaliidae**

Thiele, 1929, p. 10.

Plaxiphora parva Nierstrasz

Fig. 29 *c-e*

Plaxiphora parva Nierstrasz, 1906, p. 501, pl. 27, figs. 38-43; Leloup, 1942, p. 31, text-fig. 18 G. *Plaxiphora tricolor* Thiele, 1909a, p. 21, pl. 2, figs. 77-83; Leloup, 1937a, p. 167, figs. 12-16.

Plaxiphora indica Thiele, 1909b, p. 23, pl. 3, figs. 15-19.

Plaxiphora platei von Knorre, 1925, p. 617, pl. 32, fig. 56, pl. 35, fig. 59, text-figs. 15-17.

Sculpture over whole surface of all valves consisting of close-set circular or oval, flattened granules, mostly arranged in quincunx, each with a minute pore.

Head valve with 7 obscure radial ribs, insertion plate with 7 slits (Nierstrasz: 8). Middle valves each with a low radial rib on which the granules are rather larger and more oval in shape, with 2-3 pores; sinus wide, insertion plate with one slit. Tail valve with apex near hind margin, insertion plate without slits.

Girdle with minute calcareous platelets and spicules, and longer chitinous hair-like processes.

5×3.25 mm. (Nierstrasz); 7.5×4.5 mm. (U.C.T.).

White mottled with rose, grey, or blackish, girdle grey with brown hairs (Nierstrasz). Nierstrasz's coloured figure is buff with a blackish V-shaped mark on either side on the head and tail valves, the pleural areas on 2nd and 4th valves grey or blackish.

The U.C.T. example is greenish-blue with faint dark greyish speckling, head and tail valves pale medianly, umbo of 4th, 7th and tail valves white, girdle with cream scales and brown hairs.

Gills 13-14 (Nierstrasz: *c.* 15).

Radula with *c.* 35 rows, major lateral plate bluntly tricuspid, 1st marginal plate spatulate; the 2nd marginal appears to have a small inset piece antero-internally.

Mozambique (Nierstrasz); Inhambane (U.C.T.).

Distribution. Ceylon, Madras.

Fam. **Ischnochitonidae**

Chaetopleura papilio (Spengler)

Chaetopleura watsoni Krauss, 1848, p. 41 (Ashby quoted *papilio* in error).

Chaetopleura papilio Spengler, Ashby, 1931, p. 22, pl. 3, figs. 32, 33.

Chaetopleura destituta (non Sykes) Ashby, 1931, p. 26, pl. 4, figs. 37-39.

Dorsal-pleural areas of the middle valves finely and closely longitudinally lirate, the *interstices not punctate*; in juveniles the interstices may be minutely punctate near the beak, and minute punctae may continue to appear at later stages, but never so definite and conspicuous as in *pertusa*; lateral areas (when fresh) feebly radially lirate, with tiny granules. Head and tail valves more or less distinctly, but feebly, radially lirate, with scattered granules.

The specimen S. Afr. Mus. 4880, which Ashby identified as *destituta*, is merely a low-arched and somewhat worn example of *papilio*; the interstices between the lirae are not punctate, and therefore it cannot be *destituta*. It has similar little pale triangular spots near the outer margins of the valves, but not so numerous and conspicuous as in S. Afr. Mus. 4887 (Ashby fig. 32). Ashby

returned only the 2nd valve of S. Afr. Mus. 4874, and as can be seen from fig. 38 the sculpturing is the same as that of *papilio* fig. 32. Ashby himself (p. 27) admitted that the sculpture 'approached' that of *papilio*, but he seems to have placed more value on the 'form of shell'.

The height of the valves (angle of divergence) is a variable character (as also in *Acanthochiton garnoti* and *Dinoplax gigas*) and therefore not a good specific character.

The length given by Ashby for no. 4880 should be 58, not 68 mm.

Valves with a dark brown median stripe flanked more or less distinctly by buff, laterally with blue zigzag streaks or cuneiform spots, girdle light brown spotted with darker brown, bristles black. Width (visible) of median valve up to 34 mm.

Luderitzbucht (Thiele); Saldanha Bay (Melville & Standen, also U.C.T.); Table Bay (Krauss; also S. Afr. Mus. coll. K. H. B.); Zout Rivier and Lambert's Bay to Table Bay (U.C.T.); False Bay (U.C.T.); off East London, 27 metres (U.C.T.); 34° 33' S., 18° 20' E., 290 metres (R.S. *Africana* per U.C.T.).

Chaetopleura pertusa (Rve.)

Chaetopleura pustulatus Krauss, 1848, p. 42, pl. 3, fig. 7; Nierstrasz, 1906, p. 488, pl. 26, figs. 1-7.

Chaetopleura destituta Sykes, 1902, p. 195, text-fig.

Chaetopleura pertusus Rve., Ashby, 1931, p. 23, pl. 3, figs. 34-36.

Ischnochiton pertusus Rve., and *punctulatus* [sic] Krauss, Turton, 1932, p. 212.

[Non] *Chaetopleura destituta*: Ashby, p. 26, pl. 4, figs. 37-39. = *papilio*.

Dorsal-pleural area with numerous more or less granulate longitudinal lirae, the *interstices strongly punctate*, sometimes producing a more or less cancellate appearance; lateral area more or less distinctly radially lirate, with scattered granules. Head valve radially lirate, with scattered granules. Most of the granules are perforated.

Head valve with 10 slits (Nierstrasz, Ashby, S. Afr. Mus. 6766), 9 (Krauss). The same specimen S. Afr. Mus. 6766 has 14 slits on the tail valve (as Ashby stated), but Krauss gave 8, and Nierstrasz 10. Another South African Museum specimen (4875) has 10 slits.

Radula with major lateral plate bicuspid (Nierstrasz).

Saldanha Bay (U.C.T.); Table Bay (Nierstrasz); False Bay; Mossel Bay, Jeffreys Bay, and Algoa Bay, 15 fathoms (U.C.T.); Port Alfred (Ashby); Natal (Krauss); Durban (Sykes).

The *Pieter Faure* obtained only isolated valves at the following stations: off Cape Point, 145 fathoms; off Cape Infanta, 46 fathoms; off Cove Rock (East London), 22 fathoms; off Illovo River (Natal), 27-30 fathoms.

Remarks. I accept Ashby's recognition of *pustulatus* as a synonym of *pertusa*. But the variable development of the lirae (sometimes 'grooves' is the better term) and the little granules on the lateral areas of the middle valves indicates that *destituta* is merely a smooth variation of *pertusa*. As stated above the two examples referred by Ashby to *destituta* are certainly *papilio*.

The record of a small (rolled up 9.5×10 mm. [*sic*]) *destituta* from Rio de Oro ($24^{\circ} 41' N.$, $14^{\circ} 51' W.$) (Leloup, 1937 *b*, p. 135, figs. 4-6) is perhaps a misidentification, especially as Ashby's 1931 paper is quoted as a reference.

C. papilio seems to occur mainly on the west coast, and *pertusa* on the south coast, though they overlap according to the records. Adults are easy to distinguish, but some juveniles may cause difficulty. This may account for the record of *pertusa* from Table Bay and Saldanha Bay, and of *papilio* from False Bay.

Chaetopleura pomarium n.sp.

Fig. 29 *i*

Head valve with *c.* 15 (smaller) to 18 (larger specimen) radiating lines of small pustules; middle valves with *c.* 11-12 lines of pustules on the pleural area, dorsal area with *c.* 6-7 lines of finer pustules set closer together, lateral area with 4-5(6) radiating lines of pustules; tail valve with 6-7 more or less longitudinal lines of pustules on pleural area, 5 on dorsal area, with radiating lines of pustules behind the umbo which is slightly in front of centre.

Nearly all the pustules are perforate; surface between the pustules perfectly smooth; lateral areas of the middle plates scarcely raised but there is a smooth strip separating the radial lines from the longitudinal lines.

Slits 9 on head valve, 1 on each middle valve, 8 on tail valve (the latter rather obscure).

Girdle with minute calcareous scales, and long and short chitinous hairs.

Animal 21×14 mm.; width of middle valve 12 mm.

Buff, obscurely mottled with brown, valves paler medianly and laterally, girdle buff with more or less distinct squarish orange spots, one at each valve (i.e. 6 on each side), 2 (or 4) on tail valve, girdle around head valve uniform orange.

Gills 25-27. Radula with major lateral plate bicuspid.

Lüderitzbucht, 35 metres, Buffels River, south of Port Nolloth, Lambert's Bay, Saldanha Bay, and west coast of Cape Peninsula (U.C.T.); Kommetjie (Mrs. Connolly).

Type in the South African Museum (A9339), cotypes in Zoology Department, U.C.T.

Remarks. Nierstrasz's (1906) fig. 2 of *pustulata* might seem to represent the present form as it shows only 10 longitudinal lirae on the pleural area; his text says at least 10, but they are connected by cross-bars as in Krauss's description. This would produce a punctate appearance and it is therefore clear that he had a typical *pertusa* with punctate interstices between the lirae.

There is a distinct resemblance between the present form and *C. fernandensis* Plate (1899, p. 197, pl. 2, fig. 144, pl. xi, fig. 304) which is closely allied to *C. peruviana* (Lam.) (Plate, p. 182); nevertheless I am unwilling to identify the Cape specimens with a species from the Pacific coast of South America, without

a direct comparison and a more detailed study. Plate gave the number of gills for *fernandensis* as 30-33, and for *peruviana* as 31-44.

In one of the Lambert's Bay specimens the pustules are less numerous on all the valves: 6-7 lines on the pleural areas of the median valves, 2-4 pustules on the lateral areas.

The regularly spaced arrangement of the lines of pustules suggests the lines of trees in an orchard.

Gen. DINOPLAX Carp.

Ashby (1928, 1931) regarded *gigas*, *fossus*, and *alfredensis* as forms of one variable species; in 1934 he added another variety *validifossus*. In 1931 (p. 28) he claimed to have discussed (in 1928, p. 83) the extent of variation 'very fully', although he had only 7 specimens. In 1934 he had about 50 specimens, all from Durban.

I have examined 24 dry and 16 alcoholic specimens in the collections of the South African Museum and U.C.T.; also a dozen dry shells in a private collection. The U.C.T. material (8 alcoholic, 1 dry) has been particularly useful because it was collected at various localities from False Bay (Cape) to Umpangazi (Natal). I am also indebted to Prof. Day (U.C.T.) for allowing me to make use of his observations.

Krauss recorded *gigas* from Table Bay and Natal. But no *Dinoplax* has since been collected in Table Bay or on the west coast either by the South African Museum or U.C.T., or, as far as I am aware, by private collectors.

There appear to be three forms or species living on the South African coast, defined as follows:

1. Girdle and membrane between the valves with *scattered* tufts of short spicules. Dorsal pleural areas of median valves with fine punctate-foveolate sculpture, sometimes tending to become striate; if present the striae *converge* towards the middle line .. *gigas*
2. Girdle and membrane *densely covered* with spicules. In addition long curved spicules may be present.
 - (a) Dorsal pleural areas sculptured as in *gigas* with a tendency to form deep 'stab-like' markings or grooves, more or less longitudinal *fossus*
 - (b) Dorsal-pleural areas with strong costae radiating from the beak and *diverging* from the middle line. Ribs on lateral areas often few in number, strong, with deep intervening grooves *validifossus*

The original description is not available, but in all probability it was based on a specimen from the Cape. I have therefore assumed that *gigas* as here defined represents the typical form.

The Pyramidellid *Odostomia chitonicola* Smith 1899 (see Barnard, Part 3,

p. 91) lives commensally or as an ectoparasite among the spinelets on the girdle. It has been recorded on '*gigas*' at Umkomaas and Port Edward (Natal) (Robertson & Orr, 1961).

Dinoplax gigas (Gmelin)

Fig. 29 *f, g*

Dinoplax gigas Gmelin, Pilsbry, 1892, p. 254, pl. 57, figs. 21-32 (description quoted in Ashby, 1928, p. 82); Sykes, 1899, p. 277.

[*Non*] *Chiton gigas*: Krauss, 1848; *Dinoplax gigas*: Ashby, 1928, 1931 and 1934; Nardini, 1934. ? Bartsch, 1915, Turton, 1932, van Bruggen, 1952.

The girdle and membrane between valves with scattered bunches of spicules has a very different appearance from that of the densely spiculate girdle of *fossus* and *validifossus*. The bunches of spicules may vary in abundance and proximity, but they are always separated by bare areas. I have seen no specimen which could not at first glance be placed in the one or the other group without the slightest doubt.

The dorsal pleural area in unworn specimens is finely punctate-foveolate (somewhat similar to *textilis*, but much finer), or 'chevronate', the appearance due to the intersection of very fine more or less longitudinal and diagonally oblique riblets. On the anterior margin, protected by the preceding valve, the sculpture frequently becomes striolate. Striations may also develop on the outer part of the pleural area. These striae are perpendicular, or nearly so, to the oblique anterior border of the lateral area, and therefore converge towards the middle line.

The lateral area of the median valves is usually elevated and demarcated from the dorsal pleural areas. Usually it has radiating ribs, but these may be obscure in juveniles. The number of ribs increases with age: 3-4 obscure ribs on valve 7 in a juvenile with valve width 6.5 mm., and on valve 6 only a suggestion of one or two ribs; on a large valve 75 mm. wide there are *c.* 50 ribs.

The angle of divergence is normally about 110°; but the South African Museum material shows a range from 85° to 120°, and in one specimen 135°. This latter specimen is very flat, and the median valves are short in proportion to their width; the abnormal growth seems to have been mainly in the central portion of the valves because the lateral areas are widely separated and do not nearly reach the middle line.

Up to (dry specimens excl. girdle) 110 × 55 mm., angle of divergence 85°, and 105 × 60 mm., angle of divergence 135°. Some very large valves from middens at Cape Hangklip measure 50 mm. from the middle line to the side margin, and 75 mm. from one side margin to the other (direct); probable total length of all the valves would be about 150 mm., to which about 10 mm. might be added fore and aft for the girdle.

A 7-valved specimen, now in the South African Museum, was found at Still Bay by Dr. Muir. Recently (1962) Mrs. Connolly found one at Cape Hangklip.

Gills about 40 (juv.) to 55-60. Radula (of juvenile 23 mm. long) with *c.* 45 rows, major lateral plate tricuspid, major marginal plate spatulate.

False Bay, Cape Hangklip, Still Bay (S. Afr. Mus.). Arniston, Mossel Bay, Knysna (U.C.T.).

Dinoplax fossus Sykes

Chiton gigas (non Gmelin) Krauss, 1848, p. 30, pl. 3, fig. 3.

Dinoplax fossus Sykes, 1899, p. 277, fig. 1.

Dinoplax gigas (non Gmelin) subsp. *alfredensis* Bartsch, 1915, p. 179, pl. 39, figs. 1, 2.

Dinoplax gigas (non Gmelin) Ashby, 1928, p. 82, pl. 8, figs. 22-24; 1931, p. 27, pl. 4, figs. 40-42; 1934, p. 77, pl. 9, figs. 1, 2.

Girdle and membrane between valves densely covered with spicules. In addition long white, curved spicules may be present (possibly always present, but easily rubbed off). Dorsal pleural area sculptured as in *gigas*, but with a tendency to form deep 'stab-like' (Sykes) more or less longitudinal marks or grooves. Lateral area radiately ribbed as in *gigas*.

Natal (Krauss; Table Bay not acceptable). Umkomaas, Natal (Sykes). Port Alfred (Bartsch, Ashby, Turton). Durban (Ashby). Umzimkaba (Port St. Johns) (S. Afr. Mus.). Port Elizabeth, Richmond, Kowie, East London, Morgans Bay, Imbotje (Port St. Johns), and Umpangazi (Natal) (U.C.T.).

Remarks. The subspecies *alfredensis* can be ignored, as it was evidently based on a worn specimen. When a surface with conical pits is abraded, the pits become smaller and finer.

Dinoplax validifossus Ashby.

Dinoplax gigas (non Gmelin) Nardini, 1934, p. 250, text-fig. 1.

Dinoplax validifossus Ashby, 1934, p. 79, pl. 9, fig. 3 (as var. of *gigas*).

Girdle and membrane as in *fossus*. Dorsal pleural area with strong costae radiating from the beak and diverging from the middle line. Lateral area with the radiating ribs tending to become fewer, stronger, broader, with deep intervening grooves.

Umkomaas, Natal, from shell middens (Nardini). Durban (Ashby). Natal (exact locality ?) (S. Afr. Mus.). Qolora (north of East London) and Port Edward (south of Port Shepstone) (U.C.T.).

Remarks. The *diverging* costae on the dorsal-pleural area are very distinctive.

Nardini's figure shows that she had this species, not the (assumed) true *gigas*. The example 'found fossil for the first time' was not a true fossil in the usually accepted sense, because there are no Pleistocene deposits at Umkomaas. Shell-middens, however, do occur.

Ischnochiton textilis (Gray)

Fig. 29j

Chiton trigrinus Krauss, 1848, p. 38, pl. 3, fig. 5.

Chiton textilis Gray, Krauss, 1848, p. 38, and var. *punctulata*, p. 39.

- ? *Ischnochiton textilis* Gray, Nierstrasz, 1905, p. 142, pl. 9, fig. 1 (girdle scale: ? *hewitti*).
Ischnochiton ludwigi Pilsbry, Ashby, 1931, p. 35, pl. 5, fig. 55 (not good).
Ischnochiton textilis Gray, Ashby, 1931, p. 36, pl. 5, figs. 56-58; Stephenson, 1948, p. 268.
Ischnochiton tigrinus Krss., Ashby, 1931, p. 38, pl. 5, figs. 59-62; Turton, 1932, p. 212.
Ischnochiton reticulatus (non Rve.) Turton, 1932, p. 211.
? [*Non*] *Ischnochiton textilis*: Nierstrasz, 1905, 1906, = *hewitti*.

Head valve with 18 slits, tail valve with 14 (Ashby).

Girdle scales transversely oval, with numerous (18-20) fine pliculae.

Gills 35; I find that 30 is the more normal number.

Radula with *c.* 35 rows, major lateral plate tricuspid, major marginal plate spatulate.

Lüderitzbucht (Thiele); Saldanha Bay (Melvill and Standen, Ashby, S. Afr. Mus. P.F. coll. and U.C.T.); Table Bay; False Bay; St. Sebastian Bay; Mossel Bay (S. Afr. Mus. P.F. coll.); Port Elizabeth; Port Alfred; Umsikaba River mouth (north of Port St. Johns) (S. Afr. Mus. coll. F. H. Talbot).

Remarks. Ashby gave as the features distinguishing *tigrinus* from *textilis*: the carinated valves, the narrower sinus, and the cellular non-linear sculpture of the dorsal-pleural area. The second and third of these features are clearly shown in his figs. 57 and 58 as compared with figs. 60 and 61. Unfortunately these differences are not always so clear-cut, and I doubt whether two species can be maintained.

The smallest specimen I have seen with longitudinal grooves on the anterior margin has a valve width of 10 mm. (it has the tigrine stripes). All specimens smaller than that, e.g. 8, 6, 5, 3, and 2.5 mm. valve width, are without grooves. Thus apparently at about 10 mm. valve width *tigrinus* begins to develop longitudinal grooves and becomes *textilis*. This, however, should be checked on more material.

Both forms occur together, and both may, or may not, show the tigrine colour striping (S. Afr. Mus. series from Table Bay, coll. K.H.B.). Stephenson came to the same conclusion.

Nierstrasz (p. 493) quoted the features of *punctulata* Krss., but omitted the word obsolete ('*radiatim obsolete striatis*'); nevertheless he was probably correct in regarding this character as not being of varietal value in view of the occurrence of transitional forms.

In my opinion, however, the specimens described by Nierstrasz in 1905 and 1906 were not the true *textilis*. His description and figure of the girdle scales do not apply to *textilis*, but they do apply to *hewitti*. In 1905 Nierstrasz stated there were 7-11 strong ribs, and he figured a scale much more like that of *textilis*.

Krauss himself at first thought of using *ludwigi* as a species name, but after seeing Gray's description he identified his specimens as *textilis*, and gave a description of them. There seems no reason why Pilsbry, and after him Ashby, should have resurrected the discarded ms. name *ludwigi*.

Ischnochiton delagoensis Ashby

Ischnochiton delagoensis Ashby, 1931, p. 40, pl. 6, figs. 63-66.

A species with larger reticulation on the dorsal-pleural area than in *textilis-tigrinus*, and with the reticulation extending over the lateral area which is not ribbed.

Type (head, tail, and 4 middle valves, and part of girdle) in the South African Museum (A6589).

No further specimens have come to hand in spite of the intensive collecting done at Inhaca Island by the Zoology Department of the Witwatersrand University.

Ischnochiton hewitti Ashby

Fig. 29 k

? *Ischnochiton viridulus* (non Couthouy) Gould, Haddon, 1886, p. 16.

? *Ischnochiton textilis* (non Gray) Nierstrasz, 1906, p. 491, pl. 26, figs. 10-16.

Ischnochiton hewitti Ashby, 1931, p. 33, pl. 5, figs. 50-53; Leloup, 1939, p. 81, figs. 1-3.

Head valve with 10-13 slits (Nierstrasz), 13 (Ashby). Tail valve with 11-14 slits (Nierstrasz), 12 (Ashby). Girdle scales subcircular or slightly conical, with a few (3-7) strong plicae. Gills 23-25 (Nierstrasz).

The living Langebaan specimens were blue-green in colour (U.C.T.).

Possession Island (south of Lüderitzbucht) (Leloup); Port Nolloth (Nierstrasz); Lüderitzbucht, Port Nolloth, Langebaan (Saldanha Bay) (U.C.T.); Sea Point, Table Bay (Nierstrasz, Ashby).

Remarks. Ashby considered Haddon's record of *viridulus* from Cape Town as referable to *oniscus*; but Haddon stated that the girdle scales were 'coarsely striated', which seems to apply better to *hewitti*. See also p. 327.

Ischnochiton oniscus (Krauss)

Fig. 29 l

Chiton oniscus Krauss, 1848, p. 39, pl. 3, fig. 4.

Chiton pruinosus (non Gould) Sowerby, 1892, p. 51.

Ischnochiton oniscus Krss., Nierstrasz, 1906, p. 494, pl. 26, figs. 17-21; Ashby, 1931, p. 30, pl. 4, figs. 43-46 (not good); Turton, 1932, p. 210.

Ischnochiton oniscus Krss., subsp. *alfredensis* Ashby, 1931, p. 31, pl. 5, fig. 54 (not good).

Ischnochiton oniscus Krss., vars. *pyramidalis*, *aurantius*, *albocarinatus* Turton, 1932, p. 210, pl. 54, nos. 1458, 1459, 1460.

Ischnochiton eucosmia Turton, 1932, p. 211, pl. 54, no. 1464.

Head valve with 9-12 slits, tail valve with 9-10 slits (Ashby), 10-12 and 9-13 (Nierstrasz). Girdle scales with numerous very fine striae. The 'chaffy' appearance (Ashby) of the girdle scales seen in some specimens seems to be due, sometimes at least, to contraction of the girdle while drying, or to the method of preservation. Further study of *living* material should be undertaken.

Sykes (1894, p. 133) considered *elizabethensis* to be the same as *oniscus*, but later (1898, p. 41) reversed his opinion.

Ischnochiton elizabethensis Pilsbry

Chiton marginatus (non Pennant) Sowerby, 1892, p. 50.

Ischnochiton elizabethensis Pilsbry, 1894, p. 9; Ashby, 1931, p. 32, pl. 4, figs. 47-49 (not good); Turton, 1932, p. 211.

Ischnochiton elizabethensis Pilsbry, var. *pipperatus*, and var. *zebra* Krss., Turton, 1932, p. 211, pl. 54, nos. 1467, 1468.

This is stated to differ from *oniscus* by having coarser valve sculpture and larger girdle scales. I doubt whether it is a natural species. The distinctions given by Ashby are subtle, and merely comparative. A single specimen would be unidentifiable in the absence of one of the other kind for comparison. Even in material identified by Ashby I am unable to appreciate the differences.

The name *elizabethensis* may, however, be used as a varietal name for specimens in which the longitudinal grooves on the dorsal pleural area (well marked in typical *oniscus*) are restricted to a small or very small part of the pleural area near the girdle.

Numerous variations in colour and pattern occur (Ashby, 1928, pp. 85 and 87). Often the same pattern is found in both 'species'. Turton (p. 210) complained that it was 'provoking' to find the same marking in *elizabethensis* as in his new var. *pyramidalis*!

The distribution is coterminous: False Bay to Natal. The only record from Table Bay is by Smith (1903, p. 392); if taken from Tryon, the record is certainly unreliable.

Ischnochiton (Chondropleura) simplicissimus Thiele

Ischnochiton (Chondropleura) simplicissimus Thiele, 1906b, p. 335, pl. 29, figs. 21-25.

Valves ridged, angle of divergence *c.* 90°. Valves perfectly smooth, except for faint growth-lines; lateral area slightly raised. Umbo of tail valve at $\frac{1}{3}$ length. Head valve with 13, tail valve with 10 slits, middle valves each with one slit.

Girdle with very small scales, without distinct striation, apex with minute granules.

Animal 16 × 8 mm., width of valve 7 mm. White.

Radula, major lateral plate with simple apical cusp.

34° 33' S., 18° 21' E., 318 metres (Thiele). One specimen found among *Lepidopleurus sykesi*. Not taken by the *Pieter Faure*.

Fam. **Chitonidae***Chiton tulipa* Q. & G.

Chiton tulipa Q. & G., Ashby, 1931, p. 43.

Chiton tulipa Q. & G., var. *alfredensis* Ashby, 1928, p. 87, pl. 8, figs. 19-21; 1931, p. 43, pl. 6, figs. 67-69.

Chiton alfredensis Turton, 1932, p. 212, pl. 54, no. 1474.

There seems no need to bring in the name *alfredensis* as the short longitudinal grooves adjacent to the lateral area are not constant. They may or may

not be visible in examples from the same locality. Krauss considered that they were a juvenile feature which disappeared in later growth; Turton said vice versa! The smallest specimen I have seen would be about 18 mm. long if unrolled, from Simon's Bay (False Bay); it has no indication of the grooves. In a series from Still Bay (Dr. Muir coll.) the grooves begin to appear at a length of about 20 mm., and are quite distinct in larger shells, thus confirming Turton. Sometimes the grooves vary on the two sides of the same animal, distinct on one side, obsolete on the other side.

When very well developed there is a perplexing resemblance to *crawfordi*; in fact I have seen specimens which cannot be assigned definitely to one or the other!

U.C.T. has obtained living examples with the following coloration. From False Bay: rose-red with darker mottling, middle valves maroon, head and tail valves pink, girdle pink. From 34° 09' S., 18° 17' E., 24 fathoms: pink with crimson markings and a crimson mid-dorsal stripe, girdle mottled pink and crimson.

The locality Camps Bay mentioned by Ashby is probably correct, and although no further examples have been collected there, it is confirmed by the above U.C.T. locality, Oudekraal, a little farther south off the west coast of the Cape Peninsula. U.C.T. collected it also at Steenberg Cove on the west coast.

False Bay to East London and The Haven (Bashee River) (U.C.T.). Umsikaba River mouth (north of Port St. Johns) (S. Afr. Mus. coll. F. H. Talbot bridges the gap between Port Alfred (Ashby, Turton) and Natal (Krauss).

Chiton nigrovirescens Blainv.

Chiton capensis Gray, Krauss, 1848, p. 37.

Chiton nigrovirescens Blainv., Krauss, 1848, p. 38; Haddon, 1886, p. 22; Tomlin, 1931a, p. 417.

Chiton nigrovirens [sic] Blainv., Nierstrasz, 1906, p. 503, pl. 27, figs. 44-49; Thiele, 1910, p. 269; Ashby, 1931, p. 47, pl. 7, figs. 78-81.

Head valve with 11-14 slits, tail valve with 10-16 (Nierstrasz). Girdle scales rather rough (subgranulose). Gills 22-26. Radula with *c.* 40 rows, major lateral plate bicuspid, inner cusp larger than outer cusp, major marginal plate spatulate.

Up to 25 × 15 mm.

Lüderitzbucht (Thiele, and S. Afr. Mus. Coll. J. D. F. Gilchrist); Saldanha Bay (Melvill & Standen); Dassen Island, Table Bay, and False Bay (S. Afr. Mus.); Cape Town (Haddon). Port Nolloth to Oudekraal (west coast of Cape Peninsula), Cape Hangklip, Danger Point (U.C.T.). Ashby mentioned Port Alfred, but Turton did not collect it there. Krauss gave Natal (coll. Wahlberg), but I think this must be an error.

Remarks. Tomlin (1931) pointed out that Blainville's spelling was *nigrovirescens*.

Nierstrasz found minor differences in the radula between his examples and Thiele's, and queried the identity of the latter.

Breeding. A feature of this species which has not been observed in any other South African Chiton is the sheltering of the juveniles under the girdle of the mother (Thiele, 1910; and K. H. B. in Ashby, 1931). But see p. 327.

Chiton crawfordi Sykes

Chiton crawfordi Sykes, 1899, p. 279, fig. 2; Ashby, 1931, p. 44, pl. 6, figs. 70-73.

To the localities given by Ashby can be added: Simon's Bay (False Bay) (S. Afr. Mus.); Still Bay, dead shells (S. Afr. Mus. coll. Muir); and 34° 15' S., 25° 5' E. (St. Francis Bay), 6 fathoms, 1 living (U.C.T.).

The old record from False Bay (Nightingale & Layard) has not been confirmed by U.C.T. collecting in recent years.

The U.C.T. specimen (St. Francis Bay) is umber-brown, umbo of 2nd valve white, and white mid-dorsal patches on 3rd-5th valves, also a few white spots on posterior margins of valves, girdle maroon-brown with paler patches.

The half-grown U.C.T. (St. Francis Bay) specimen, width of middle valve 6 mm., is unworn and shows the longitudinal lirae on the dorsal area of middle valves extending to the mid-dorsal line, but narrower and finer than those on the pleural area; the lateral areas have 6-7 radial lirae; the head valve has c. 40 radiating lirae.

Remarks. Although *crawfordi* is really only a *tulipa* with well-developed dorsal grooves, it may be retained as a species for the time being (*vide supra*).

Chiton barnardi Ashby

Chiton barnardi Ashby, 1931, p. 46, pl. 6, figs. 74-76, pl. 7, fig. 77.

The whole surface appears minutely shagreened, but this is due to coloration, not to pits or granules; the surface is smooth. The groove between the 2 ribs on the lateral area of the middle valves is pitted (or as Ashby would have said: the lateral nodules of the ribs bridge the sinus). The longitudinal ribs on the pleural area of the middle valves are quite simple and straight-sided, without any lateral nodules or irregularities.

I have seen one specimen, c. 10 mm. long, from Nossy-Bé, Madagascar (U.W.). The grooves on the middle valves do not extend to front margin of valve, especially towards the middle line. This is also the case in the one valve of the paratype (the only valve returned by Ashby).

Pale pinkish, tail valve with black patch on either side, 6th valve with a small patch on right side only, girdle pale with slightly darker grey patches.

Chiton ashbyi n.sp.

Fig. 29 m

A single middle valve has similarities with *barnardi*, having the pleural area longitudinally ribbed, and the lateral area with 2 strong ribs. Pleural area with 10-11 longitudinal, laterally irregularly nodulose (submoniliform)

ribs (sometimes bifurcating or anastomosing); dorsal area with 4 ribs, slightly broader and less moniliform (perhaps because more worn); lateral area with 2 very strong nodulose ribs, with a narrow deep sulcus. Umbo corroded. Sutural laminae and insertion plates worn away. Length 3.3, width 9 mm.

Off Cape Infanta, 46 fathoms, 1 middle valve (S. Afr. Mus. A9337, P.F. coll.).

Remarks. This valve is so unlike any other South African Chiton, except *barnardi*, that although the head and tail valves are missing, I propose a n.sp., and reciprocate Ashby's compliment by naming it after him.

It may be a *Callistochiton* (subgen. of *Lorica* in Thiele, 1929), several species of which have a similar sculpture (cf. Nierstrasz, 1905, pp. 143, 146, pl. 9).

Acanthopleura brevispinosa (Sow.)

Acanthopleura brevispinosa Ashby, 1931, p. 49, pl. 7, fig. 82.

In 1905 (*Notes Leyden Mus.* xxv, pp. 151, 152) Nierstrasz recorded examples of *spinigera* Sow. and *granulata* Gmelin from 'Cape of Good Hope'. Ashby (pp. 49, 53) put the former in the synonymy of *brevispinosa*, but did not mention the latter. Smith (1910, Ann. Natal Mus. ii, pp. 211, 212) listed both without commenting on the locality. It is most unlikely that the West Indian *granulata* occurs anywhere in the South African region, and this species should be deleted from the fauna-list.

A. brevispinosa has been found at Santa Carolina, Bazarute Is. (U.W.), but so far as I am aware not farther south. Neither myself (1912) nor U.W. found it at Inhaca Island (Delagoa Bay).

Onithochiton literatus (Krss.)

Onithochiton literatus Krss., Nierstrasz, 1906, p. 505, pl. 27, figs. 50-53; Ashby, 1931, p. 50, pl. 7, figs. 83-86 (synonymy); Macnae & Kalk, 1958, p. 127 (listed) (*literatus*) [*sic*].

Plaxiphora wahlbergi Krss., Eyre & Stephenson, 1938, p. 38 (habitat).

Port St. Johns (S. Afr. Mus. coll. G. Shortridge) seems to be the most south-westerly locality recorded. I have (1962) seen a specimen from Xora (Elliotdale Division), about 7 miles north of Bashee River mouth; and another from Coffee Bay, a little farther north. Umhlali, Durban, Umtwalumi (U.C.T.). Inhaca Is., Delagoa Bay (McNae & Kalk). Krauss described *wahlbergi*, which Ashby regarded as synonymous, from Table Bay. This surely is due to some error in labelling (cf. *Dinoplax gigas*).

The Xora specimen was mottled crimson.

Gills 35-38 (Nierstrasz). Radula, major lateral plate 4-cuspid (Nierstrasz).

The Mauritian species *maillardi* (Desh.) is closely allied.

SOLENOGASTRES

Aplacophora Fischer, 1885, p. 884.

Solenogastres Thiele, 1902, p. 249; Nierstrasz, 1902, p. 1; Thiele, 1913, p. 1; Leloup, 1950, p. 1.

The only Solenogastrid hitherto recorded from South Africa has been *Archaeomenia prisca* (*infra*). In August and December 1959 Dr. F. H. Talbot,

Marine Biologist of the South African Museum on board the Fisheries Survey R.S. *Africana II*, obtained several examples at the following stations:

St. A191. 33° 36' S., 16° 15' E., 1,520–1,570 fathoms.

St. A193. 33° 49' S., 16° 30' E., 1,500 fathoms.

St. A316. 34° 42' S., 16° 54' E., 1,725–1,780 fathoms.

At least two species are represented. One slender species 35–40 mm. long, 1–1.5 mm. diam.; the other 45–50 × 5–8 mm.

The identification of these specimens must wait until sections have been cut.

Archaeomenia prisca Thiele

Archaeomenia prisca Thiele, 1906a, p. 315, pl. 28.

35° 9' S., 18° 32' E., 564 metres (Thiele).

Two specimens were taken by U.C.T. in False Bay: 34° 23' S., 18° 40' E., 88 metres; bottom: green mud.

The radula of one specimen was extracted, but the number of teeth in each transverse row, 12 according to Thiele, could not be checked, nor could any bifid or trifid teeth be discerned along the margin.

SCAPHOPODA

Fam. **Dentaliidae**

Jaekel (1932, p. 307) gave a key to the South African species, but evidently had not seen Tomlin's paper (1931b). His key is now no longer useful.

Dentalium strigatum Gould

Dentalium strigatum Gould, 1859, p. 166; Bartsch, 1915, p. 180, pl. 44, fig. 5; Tomlin, 1931b, p. 337; Jaekel, 1932, p. 303.

Dentalium dentalis (non Linn.) Watson, 1886, p. 11.

Dentalium lessoni (non Desh.) Sowerby, 1892, p. 48.

Dentalium belcheri Sowerby, 1903, p. 231.

Dentalium novemcostatum (non Lam.) Sowerby, 1903, p. 231.

Dentalium agulhasense Plate, 1908, p. 349, pl. 30, figs. 21–23; Jaekel, 1932, p. 303.

At the apical end the number of ribs is 9–10, the number increasing later to 11–12–14; intermediaries if present feeble; no longitudinal striae in the grooves. Up to 32 mm.

False Bay (Gould); 34° 51' S., 19° 37' E., 80 metres (Plate; Jaekel); East London area to False Bay, 18–46 fathoms (S. Afr. Mus. P.F. coll.).

34° 8' S., 24° 59' E., 80 metres; 33° 50' S., 25° 48' E.; 35° 19' S., 20° 12' E., 126 metres (Jaekel).

33° 03' S., 28° 11' E., 31 fathoms (U.C.T.).

Remarks. The *Challenger* example from False Bay, 15–20 fathoms, should probably have been identified as *strigatum*.

The specimens returned by Sowerby labelled *belcheri* and *novemcostatum*

do not seem to show any differences. There is no doubt that Plate's *agulhasense* is the same species although Jaeckel accepted it as distinct.

Dentalium plurifissuratum (Sow.)

Schizodentalium plurifissuratum Sowerby, 1894, p. 158, pl. 12, fig. 24.

Fissidentalium plurifissuratum Sow., Pilsbry and Sharp, 1897, p. 82, pl. 6, figs. 87-89.

Dentalium plurifissuratum Sow., Sowerby, 1903, p. 231; Plate, 1908, p. 344, pl. 30, figs. 12-16; Bartsch, 1915, p. 181.

Dentalium multistriatum (non Desh.) Plate, 1908, p. 347; Jaeckel, 1932, p. 304.

Moderately curved. Ribs numerous, rounded, subequal to the grooves. Both ribs and grooves finely longitudinally striated. Growth-lines distinct. Striations and growth-lines sometimes forming a microcancellate sculpture in the grooves. One to five elongate perforations; sometimes none; sometimes an apical slit, sometimes an apical slit plus 4-5 perforations (depending on the length of the apical portion which has been broken off, or absorbed by the animal).

There is considerable variation in the ribbing. In the smallest specimens there are nearest the apex 12-14 ribs; at 15 mm. the number has increased by interpolation to 17-18, at 20 mm. to *c.* 25-28, at 30 mm. to *c.* 28-30, at 40-60 mm. to *c.* 30-34; in the larger shells the average number of main ribs (i.e. original ribs plus intermediaries which have now become large enough to be called main ribs) is 26-28, with 4-6 intermediaries. In one 70-mm. shell there are at a length of 60 mm. $26 + 8 = 34$ ribs, but in the last 10 mm. splitting and interpolation has increased the total number to 58.

Length 5, diam. aperture 0.75, apex 0.25 mm.; $8 \times 1.3 \times 0.3$; $15 \times 1.5 \times 0.3$; $22 \times 2.3 \times 0.4$; $35 \times 4 \times 0.75$; $55 \times 6 \times 1$; $65 \times 7.3 \times 1$; $70 \times 8 \times 1.75$ mm.

Radula with 14-15 rows, central plate wide, lateral plate unicuspid.

From the East London area extending across the Agulhas Bank, including Browne's Bank on the southern point of the Agulhas Bank (approx. $36\frac{1}{2}^{\circ}$ S., $21\frac{1}{2}^{\circ}$ E.) to the mouth of False Bay, 40-130 fathoms (S. Afr. Mus. P.F. coll.).

$34^{\circ} 8' S.$, $24^{\circ} 59' E.$, 80 metres; $35^{\circ} 16' S.$, $22^{\circ} 26' E.$, 155 metres; $35^{\circ} 9' S.$, $18^{\circ} 33' E.$, 564 metres (Plate; Jaeckel).

Plettenberg Bay, 60-75 fathoms, Algoa Bay, 99 fathoms (U.C.T.).

Distribution. Angola ($16^{\circ} 26' S.$, $11^{\circ} 41' E.$) (Jaeckel).

Remarks. An abundant and characteristic species. Frequent in the P.F. bottom samples.

Plate apparently had not seen Sowerby's 1903 paper in which the occurrence of this species on the Agulhas Bank was recorded. Sowerby's original locality was '? Hong Kong'; but his recognition of his own species may be accepted as indicating this species as South African, not Chinese.

The worn shells referred by Plate to *multistriatum* should, in my opinion, have been referred to *plurifissuratum* although Jaeckel accepted Plate's identification.

Bartsch's record is obviously based on a P.F. shell acquired by the U.S. National Museum from Sowerby.

Verco's remarks (1904, pp. 136, 137) on the variability of an Australian species (*intercalatum* Gould), based on numerous specimens collected by himself, are here apposite.

Dentalium exasperatum Sow.

Fig. 30 c

Dentalium exasperatum Sowerby, 1903, p. 225, pl. 5, fig. 12; Bartsch, 1915, p. 181; Jaeckel, 1932, p. 305.

Dentalium platei Jaeckel, 1932, p. 303, figs. 1, 2.

The microserrulate profile of the ribs, especially noticeable on the earlier part of the shell, easily distinguishes this species from *plurifissuratum*, which also often has microcancellate sculpture in the grooves. The present species has an apical slit, but no perforations.

At apex (when present) 13 ribs, the number increasing by interpolation to 40-44 in specimens 40 mm. long.

Length 16, diam. aperture 2, apex 0.3, slit 2 mm.; $27 \times 4 \times 0.8$, slit 2.5; $30 \times 4 \times 0.75$, slit 5; $32 \times 5 \times 1$, slit 4; $39 \times 5 \times 1$, slit 4.3; 40×5 mm. (apex broken).

Radula with 15 rows, lateral plate unicuspid.

Off Umvoti River (Natal), $4\frac{1}{2}$ miles, 27 fathoms (Sowerby).

$34^{\circ} 51' S.$, $19^{\circ} 37' E.$, 80 metres; $35^{\circ} 16' S.$, $22^{\circ} 26' E.$, 155 metres (Jaeckel).

Off Hood Point (East London), 49 fathoms, 6 dead; off Umvoti River, 56 fathoms, 1 dead; off Umhloti River, 100 fathoms, 4 living, 2 dead; off Cape Natal, 47 fathoms, 8 dead; off O'Neil Peak (Zululand), 90 fathoms, 2 dead, rather worn; off Cape Vidal (Zululand), 80-100 fathoms, 2 dead (S. Afr. Mus. P.F. coll.).

Port Alfred (littoral, dead) (Bartsch, Turton).

Distribution. Angola ($16^{\circ} 25' S.$, $11^{\circ} 41' E.$) (Jaeckel).

Remarks. A 32-mm. specimen in the South African Museum (A5461) with Sowerby's autograph label may be the Type; according to the P.F. number on the label, however, it was taken with the same bearings off Umvoti but 15 miles off shore in 56 fathoms.

D. platei is clearly a synonym. In his count of the ribs Jaeckel did not distinguish main ribs and intermediaries. The specimen referred by Jaeckel to *exasperatum* had only 10 ribs.

Dentalium platypleurum Tomlin

Fig. 30 b

Dentalium platypleurum Tomlin, 1931b, p. 339.

The fine raised growth-lines produce a slight moniliform appearance on the ribs, and in profile a slight crenulation, not scabrous as in *exasperatum*. The grooves appear punctate.

Radula with 14 rows, lateral plate unicuspid.

Off Itongazi River (Natal), 25 fathoms, 1 living (Tomlin, P.F. material); also from the same haul 2 dead, not seen by Tomlin.

Off Umhlanga River, 22-26 fathoms, 1 dead; off Morewood Cove (Natal), 27 fathoms, 5 dead; off Umhloti River, 27 fathoms, 4 dead (S. Afr. Mus. P.F. coll.).

Type in the South African Museum (No. A3631).

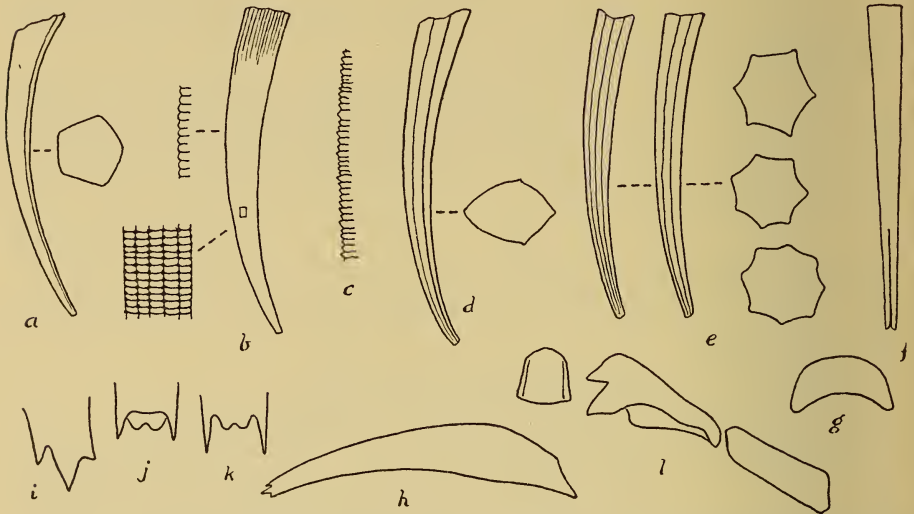


FIG. 30. *a*, *Dentalium subterlineatum* Tomlin, with cross-section; *b*, *D. platypleurum* Tomlin, with profile of rib, and sculpture further enlarged; *c*, *D. exasperatum* Sow., profile of rib; *d*, *D. capense* Tomlin, with cross-section; *e*, *D. natalense* n. sp., two variations, with cross-sections of 6-, 7-, and 8-ribbed shells; *f*, *D. engischistum* n. sp.; *g*, *D. salpinx* Tomlin, central plate of radula; *h*, *Cadulus promontorii* n. sp., *i*, *j*, *k*, lateral, dorsal, and ventral views of apex, *l*, radula plates.

Dentalium subterlineatum Tomlin

Fig. 30 *a*

Dentalium subterlineatum Tomlin, 1931*b*, p. 337.

Cape Point N. 86° E., 43 miles, 900 fathoms (Tomlin, P.F. material).

Cape Natal (Durban) N. × E. 24 miles, 440 fathoms, 6 dead (S. Afr. Mus. P.F. coll.).

The Natal specimens agree perfectly with the Type but are larger: 20, diam. aperture 2.3, apex 0.5 mm.

Type in the South African Museum (A6192).

Dentalium salpinx Tomlin

Fig. 30 *g*

Dentalium salpinx Tomlin, 1931*b*, p. 338, text-fig.

In Tomlin's description the word 'narrow' should be inserted after his words 'rounded . . . grooves'. The grooves are always narrower than the ribs, though the latter often vary in width.

The number of ribs in the Type is actually 32. Another specimen 70 mm. long from the same lot has 37 ribs; other specimens at 15 mm. have 23 ribs, at 40 mm. 25-27 ribs, at 45 mm. 30 ribs.

The ribs extend for 40-50 mm., sometimes to 60 mm. from the apex, but thereafter are evanescent or obsolete; in one specimen the ribbing ceased at 35 mm.

Up to 80, diam. aperture 10, apex 1.5 mm. No slit.

The smooth, polished, ivory-white basal portion usually contrasts with the dull grey colour of the rest of the shell; the apical one-third, or even half, of the shell is usually corroded.

Radula with 17-19 rows, lateral plate unicuspid.

Cape Point NE. $\frac{3}{4}$ E. 40 miles, 700-800 fathoms, 15 living (Tomlin, P.F. coll.).

Cape Point NE. \times E. $\frac{1}{4}$ E. 38 miles, 750 fathoms, 4 living; NE. \times E. $\frac{1}{2}$ E. 43 miles, 900 fathoms, 11 living; N. 77° E. 660-700 fathoms, 1 living; NE. $\frac{1}{4}$ N. 46 miles, 760 fathoms, 18 living (S. Afr. Mus. P.F. coll.).

Type in the South African Museum (A5459).

Remarks. Some specimens carry a commensal Actinian; cf. *D. cornu-bovis* Smith, 1909, pl. 23, figs. 2, 2a.

Dentalium capillosum Jeffreys

Dentalium capillosum Jeffreys, 1877, p. 153; 1882, p. 658, pl. 49, fig. 1; Watson, 1886, p. 1, pl. 1, fig. 1; Tomlin, 1931b, p. 339; Nicklès, 1955, p. 106.

According to Jeffreys very large specimens, size not quoted, were taken by the *Travailleur* (this work not available in South Africa).

The specimen identified by Tomlin is 35 (not 38), diam. aperture 3, apex 0.8 mm. There are 20 ribs at apex, 36 at a length of 24 mm., ribs obsolete on the last 10 mm. on convex side, but on the concave side extending more or less distinct up to 2-3 mm. from aperture.

A dead specimen 22 mm. long was found in the bottom-sample from the same haul.

Although *capillosum* has a wide distribution in the North Atlantic as far south as 4° 50' N., its presence off the Natal coast is perhaps rather surprising. Tomlin's identification, however, based on comparison with *Challenger* material, is here accepted.

Dentalium capense Tomlin

Fig. 30 d

Dentalium capense Tomlin, 1931b, p. 340; Barnard, 1963b, p. 446.

In Tomlin's description of the position of the lateral keel the words 'convex' and 'concave' should be transposed: the keel is nearer to the concave

(dorsal) side. The second lateral keel ('angular line') is nearer the convex side and much feebler; it is not seen in cross-section at the aperture. The keel on the convex side is not quite so sharp as that on the concave side.

Up to 19×2.5 (maj. diam.) mm.; Type 16×1.9 mm.

Cape Point N. 86° E., 43 miles, 900 fathoms, 1 dead (Tomlin, P.F. material).

Cape Natal (Durban), N. \times E. 24 miles, 440 fathoms, 1 dead (S. Afr. Mus. P.F. coll.).

$33^\circ 50'$ S., $17^\circ 21'$ E., 600 fathoms, 1 living, 2 dead (S. Afr. Mus. F. H. Talbot coll.).

Type in the South African Museum (A6191).

This species and *subterlineatum* occur in deep water off both Cape Point and Durban.

Dentalium natalense n.sp.

Fig. 30 e

Moderately curved. Ribs 6 (4 specimens) or 7 (47 specimens), or 8 (22 specimens); towards basal end indications of 3-4 fine intermediaries (one between a pair of main ribs); at least 15 fine striae between each pair of main ribs; growth-lines fine. No slit or perforations. White. Up to 22×2.5 (diam. aperture) mm.

Off Umhloti River (Natal), 100 fathoms, 1 (6 ribs); off Hood Point (East London), 49 fathoms, 17 (1 with 6, 12 with 7, 4 with 8 ribs); off Cape Natal (Durban), 85 fathoms, 49 (2 with 6, 32 with 7, 15 with 8 ribs) (Type series); off Cape Vidal (Zululand), 80-100 fathoms, 4 (1 with 7, 3 with 8 ribs); off O'Neil Peak (Zululand), 90 fathoms, 2 with 7 ribs; all dead (S. Afr. Mus. A5482, A9363, A9364 (Type series), A9365, A9366, P.F. coll.).

Remarks. All the specimens are dead, and perhaps none of them is fully grown.

At two localities specimens with 6, 7 and 8 ribs occur; at one locality specimens with 7 and 8 ribs, at another locality 2 specimens with 7 ribs, and at one other locality 1 specimen with 6 ribs. As all the specimens agree except in the number of main ribs, it is a reasonable assumption that they all belong to one species.

Compare the variability in the number of ribs in the West African *D. coarti* Dautz. 1912, see Nicklès, 1955, p. 105.

A larger example of *octagulum* Donovan (= *octagonum* Lam.) from Japan, whose broken apex is of the same diameter as that of the aperture of the largest Natal shell, shows much stronger intermediaries between the main ribs.

The 6-ribbed Natal specimens agree with the apical portion of a Chinese *sexcostatum* Sow.

The relative numbers of specimens seem to indicate that the 7-ribbed form is the normal form, and therefore a n.sp. is instituted.

Dentalium africanum Sow.

Dentalium africanum Sowerby, 1903, p. 224, pl. 5, fig. 10.

Up to 60, diam. aperture 6, apex 1.5 mm. A shell $47 \times 5 \times 1$ mm. has a slit 4 mm. long.

Radula with 15 rows, lateral plate unicuspid.

Off Umtwalumi River (Natal), 25 fathoms, living and dead (Sowerby).
Off Morewood Cove (Natal), 27 fathoms, 3 living, 1 dead; off Illovo River (Natal), 27-30 fathoms, 3 living, 1 dead; off Durnford Point (Zululand), 34 fathoms, 1 living, 3 dead; off Cape Vidal (Zululand), 22 fathoms, 1 living, 2 dead; off Rame Head (south of Port St. Johns), 43 fathoms, 1 dead (S. Afr. Mus. P.F. coll.).

Cotypes in the South African Museum (A5489).

Dentalium inflexum Sow.

Dentalium inflexum Sowerby, 1903 (July), p. 224, p. 5, fig. 11.

Radula with 14 rows, lateral plate unicuspid.

Off Tugela River (Natal), 14 fathoms, living (Sowerby).

Off Amatikula River (Natal), 24 fathoms, 1 dead; off Umhloti River, 27 fathoms, 1 living, 1 dead; off Cape Vidal (Zululand), 22 fathoms, 1 dead (S. Afr. Mus. P.F. coll.).

Cotypes in the South African Museum (A5470).

Remarks. According to Sowerby, differs from *longitrorsum* Rve. by being finely striate; but a Philippine example of the latter in the South African Museum is finely striate at the apical end.

Smith (1903, Oct., p. 393) recorded *longitrorsum* from Durban (coll. Burnup), but had not then seen Sowerby's description of *inflexum*. One or other of the species names should probably be deleted from the South African fauna-list.

Dentalium engischistum n.sp.

Fig. 30 f

Dentalium politum (non Linn.) Sowerby, 1903, p. 231.

Moderately curved when young, straightening later. Surface smooth, polished, fine growth-lines showing through, but not incised. Slit a mere crack, long, often one-third length of shell.

Up to 30, diam. aperture 3 mm., slit 8-10 mm.

Radula with 14-15 rows, lateral plate unicuspid.

Off Cape Natal (Durban), 62 fathoms, 7, living and dead (Type series); off Cape Natal, 54 fathoms, about 100, mostly dead but fresh, a few living; off Umhloti River, 100 fathoms, 8, living and dead; off Cape Natal, 47 fathoms, 9 living and dead (S. Afr. Mus. A5463 (Type series), A5464, A5465, A5493, P.F. coll.).

Remarks. Sowerby (1860, p. 100) stated that *politum* was 'distinguished from all other species by the incised lines which divide its whole length into oblique rings', a feature which is clearly shown on his pl. 225, fig. 46 (see also: Boissevain, 1906, pl. 1, fig. 20, after Deshayes). Sowerby also said that *politum* was very rare in a Recent state but common as a fossil in the Paris basin.

It seems unlikely that the Natal shells, which show no trace of incised lines, should be identical with a European fossil.

The long apical slit is comparable with that of 'translucidum' (*non* Deshayes) figured by Sowerby (1860, pl. 225, fig. 47), which was renamed *stenoschizum* by Pilsbry and Sharp, 1897 (see Boissevain, 1906, p. 59).

Fam. **Cadulidae**

Plate, 1908, p. 358 (*Siphonodentalidae*); Thiele, 1934, p. 780 (*Siphonodentaliidae*).

As *Cadulus Philippi* 1844 antedates *Siphonodentalium* M. Sars 1859, the family name should be taken from the former.

Cadulus booceras Tomlin 1962 and *C. platei* Jaeckel, 1932, are the only species recorded up to the present from South Africa. Among the Pieter Faure Scaphopods sent to Tomlin, however, were two species. These Tomlin identified but did not include in his 1931 Report on the Scaphopoda (Ann. S. Afr. Mus. xxix, pp. 337 sqq.).

Cadulus cylindratus Jeffreys

Cadulus cylindratus Jeffreys, 1877, p. 158; 1882, p. 664, pl. 49, fig. 6.

Smooth, glossy. Symmetrically curved, slightly swollen in middle or slightly nearer anterior end; aperture slightly oblique, subcircular; apex transverse, entire, oval, without internal perforated discs. 4.45 × 0.8–0.9 mm.

Radula with 14 rows, central plate as long as wide, lateral plate bicuspid, marginal plate 3 times as wide as long.

Cape Point N. 89° E. 36 miles, 700 fathoms, a dozen specimens, some living (S. Afr. Mus. A7461, P.F. coll.).

Distribution. North Atlantic.

Remarks. Tomlin's identification is accepted. The specimens appear to agree with Jeffreys's 1882 figure; his 1877 description I have not seen.

Cadulus cf. *booceras* Tomlin

Cadulus booceras Tomlin, 1926a, p. 298, pl. 16, fig. 11.

A single specimen from each of the following localities: off Cape Vidal (Zululand), 80–100 fathoms; off Hood Point (East London), 49 fathoms.

Without further material and direct comparison with examples of Tomlin's Durban Bay species, it is better to leave these small (4.5 and 5.3 mm.) specimens unnamed.

Another single example 8 mm. long, from off Cape Natal (Durban), 85 fathoms, may be a *Cadulus* (*Dischides*) or possibly a *Siphonodentalium*.

Cadulus platei Jaeckel

Cadulus platei Jaeckel, 1932, p. 311, fig. 11.

Diameter largest in the middle; apex slightly oblique, with internal perforated thickening; apex and aperture subcircular. 8×1.2 mm. (text), 24×9 (fig.).

$35^{\circ} 19' S.$, $20^{\circ} 12' E.$, 126 metres, 1 (Jaeckel).

Remarks. The discrepancy in size between text and figure is unfortunate, and renders identification uncertain.

Cadulus promontorii n. sp.

Fig. 30 *h-l*

Smooth, glossy; curved, swollen at or slightly in advance of anterior third; aperture oblique, slightly oval; apex with 2 notches on each side, the ventral notches deeper than the dorsal notches, between them a triangular tooth-like projection, the dorsal margin between the lateral projections very slightly arcuate, the ventral margin bilobate. 17.5 mm., width in front (vertical to axis) 2, at widest part 3, at apex 1 mm.

Animal (as preserved) with the foot slightly bulbous at the apex, with a small central pit. Jaw semicircular. Radula amber-coloured, with 15-16 rows, central plate slightly longer than wide, slightly narrower in front, side margins slightly thickened, lateral plate bicuspid on hinder rows, but blunt on the front rows, marginal plate $3\frac{1}{2}$ times as wide as long.

Cape Point N. $89^{\circ} E.$ 36 miles, 700 fathoms, 5 (1 retained by Tomlin) living (S. Afr. Mus. A7460 (Types), P.F. coll.).

$33^{\circ} 50' S.$, $17^{\circ} 21' E.$, 600 fathoms, 3 living (S. Afr. Mus. A9705, F. H. Talbot coll.).

Remarks. Tomlin identified the P.F. specimens as *colubridens* Watson, a species known from New Zealand (*Challenger*), East Indies (*Siboga*), and East coast of Africa (*Valdivia*). They cannot possibly be this species because of the indented apex; Tomlin evidently considered the notches to be due to accidental breakage.

The apex of the shell has a somewhat fanciful resemblance to Cape Point, flanked on the south-west by Cape Maclear and on the north-east by another headland.

Some of the Foraminifera found in the pharynx were remarkably large, and apparently could only have been drawn in through the aperture of the shell with difficulty.

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